

Proceedings of the Nutrition Society

Abstracts of Original Communications

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All abstracts are prepared as camera-ready material.

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Serum vitamin D and parathyroid hormone concentrations in a group of 50 to 70-year-old Irish women. By T.R. HILL, M.M. O'BRIEN, M. KIELY, A. FLYNN and K.D. CASHMAN, *Department of Food Science, Food Technology and Nutrition, University College, Cork, Republic of Ireland*

Plasma or serum 25-hydroxyvitamin D₃ (25(OH) D₃) is the most commonly used index of vitamin D status. Low 25(OH) D₃ status, which is most likely to occur during late winter to early spring, may increase parathyroid hormone (PTH) concentrations, which, in turn, can lead to increased bone turnover and risk of bone mineral loss. While there is some limited data on the vitamin D status of elderly (>70 years) Irish women (Meade *et al.* 1986; Freaney *et al.* 1993), there is a dearth of information on the vitamin D status of Irish women aged 50–70 years, a group at increased risk of osteoporosis-induced osteopenia.

In the current study, fasting blood samples were collected (between 08.00 and 10.00 hours) from sixty-six apparently healthy free-living Irish women from the Cork city region, by advertising in a local newspaper. Respondents were aged between 50 and 70 years (mean age was 60 years). Blood sampling took place during February and March 2002. Bloods were processed to serum and analysed for 25(OH) D₃ and PTH by enzyme-immunoassays (IDS Ltd, UK). The quality of serum 25(OH) D₃ analysis in our laboratory is assured on an ongoing basis by participation in the DEQAS external quality assurance scheme (London, UK). Serum 25(OH) D₃ cut-off values for defining vitamin D status as adequate, marginally deficient or severely deficient were: >40 nmol/l, 25–40 nmol/l and <25 nmol/l, respectively (Vieth, 1999). The adult normal range for PTH is 0.8–3.9 pmol/l, and PTH levels >4.1 pmol/l were indicative of a state of hyperparathyroidism (as indicated by IDS Ltd). The current use of vitamin D-containing supplements was ascertained by questionnaire. None of the women had been on a sunshine holiday during the 3 months previous to the blood sampling period.

Mean serum 25(OH) D₃ concentration in all subjects (*n* 66) was 56.3 nmol/l (range 16.7–114.5 nmol/l). Of the women tested, 24% and 6% could be classified as marginally and severely vitamin D deficient, respectively. However, of the 66 women sampled, 55% were taking a vitamin D-containing supplement (containing 5–10 µg vitamin D). Dividing the group into vitamin D supplement users and non-users revealed that of the supplement users none were severely vitamin D deficient and 17% were marginally vitamin D deficient. However, on the other hand, 37% and 13% of the non-supplement users were marginally or severely vitamin D deficient, respectively. In addition, the mean (SD) serum 25 (OH) D₃ concentration in women taking vitamin D-containing supplements was significantly (*P* = 0.001) higher than that in women not taking supplements (64.7 (23.4) versus 46.2 (20.8) nmol/l, respectively). Mean serum PTH concentration in all subjects (*n* 66) was 2.55 pmol/l (range 0.26–6.15 pmol/l). There was no significant difference (*P* = 0.262) in serum PTH levels between women who took vitamin D-containing supplements and those who did not (2.70 (1.26) versus 2.28 (1.16) pmol/l, respectively). In addition, 12% of the women could be classified as being in a state of hyperparathyroidism (PTH levels >4.1 pmol/l). Linear regression analysis showed there was no significant (*P* = 0.194) correlation between serum PTH and 25 (OH) D₃.

In conclusion, a significant number of 50 to 70-year-old Irish women may be at risk of hypovitaminosis D during winter and early spring-time. Consumption of vitamin D-containing supplements appeared to protect against severe vitamin D deficiency and lessened the prevalence of marginal vitamin D deficiency in this group of women. In spite of the marked depletion in vitamin D stores in some women after the winter, in general the PTH concentrations of these subjects remained within the normal range. Further research is needed to determine the impact of hypovitaminosis D on bone metabolism and bone health in this age group.

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Freaney R, McBrinn Y & Melaich JM (1993) *American Journal of Clinical Nutrition* **58**, 187–191.

Meade A, Moloney M & O'Keefe D (1986) *Irish Medical Journal* **79**, 359.

Vieth R (1999) *American Journal of Clinical Nutrition* **69**, 842–856.

Polysaturated fatty acid modulation of the immune response as assessed by cytokine production. By G.A. GILMORE, J.M.W. WALLACE and W.S. GILMORE, *Northern Ireland Centre for Diet and Health (NICHE), Faculty of Life and Health Sciences, University of Ulster Coleraine, Co. Londonderry, BT52 1SA*

The immune system encompasses a complex multitude of cells and chemical messengers, principally involved in the detection and elimination of pathogens. Among these cells are monocytes, functioning in both the innate and adaptive response, which are capable of producing a number of chemical messengers known as cytokines, including tumour necrosis factor (TNF)α and interleukin (IL)-1β. Although cytokine production is tightly controlled under normal physiological conditions, elevated levels of both TNFα and IL-1β have been reported under inflammatory conditions, including heart disease and rheumatoid arthritis (Bruunsgaard *et al.* 2000; Feldmann *et al.* 1996). Monocytes have been reported to be composed of at least two subsets, CD14⁺CD16⁺ and CD14⁺CD16⁺, with an expanded CD16 positive subset being reported within various inflammatory conditions (Nockher & Scherlich, 1998). Modulation of the immune response, as assessed by an alteration in cytokine production, has been observed with various dietary components, including the polyunsaturated fatty acids (PUFA) (Endres *et al.* 1989), although whether PUFA exert their effect at the intracellular or extracellular level remains unclear.

The aim of the current study was to investigate whether PUFA modulate intracellular monocyte TNFα and IL-1β production *ex vivo* and also to ascertain whether PUFA exert an effect on the proportion of CD16 positive monocytes. Briefly, peripheral blood mononuclear cells were isolated from seven apparently healthy individuals and incubated with either 20 µg/ml arachidonic acid (AA), 20 µg/ml of an eicosapentaenoic (EPA)/docosahexaenoic acid (DHA) mix or an ethanol control for 24 h, with a bacterial lipopolysaccharide stimulus added for the final 4 h of the incubation to induce cytokine production. Intracellular TNFα and IL-1β production was assessed within the monocyte population by flow cytometry. Briefly the technique involved staining cells with CD14 FITC to identify monocytes and cytokine-specific antibodies (TNFα PE and IL-1β PE). Results are expressed as mean and standard error of the mean (SEM) of the mean cell fluorescence (MCF). One-way analysis of variance (ANOVA) was used to test for a significant effect of PUFA.

	Intracellular cytokine production (MCF)		
	TNFα		IL-1β
	Mean	SEM	Mean
Control	49.17	2.28	49.42
AA	38.86 ^a	0.87	2.51
EPA/DHA	29.19 ^b	1.80	2.10
Significantly different from control: ^a <i>P</i> < 0.01, ^b <i>P</i> < 0.001.			

The addition of AA significantly lowered monocyte intracellular TNFα (*P* < 0.01) and IL-1β (*P* < 0.01) compared with the control. However, the lowest levels of TNFα and IL-1β were observed in monocytes incubated with the EPA/DHA mix (*P* < 0.001). In addition both AA and the EPA/DHA mix significantly lowered the proportion of CD16-positive monocytes (*P* < 0.01, *P* < 0.01). In summary, both AA and an EPA/DHA mix showed potential anti-inflammatory properties *ex vivo*, reducing intracellular cytokines. Furthermore, PUFA supplementation decreased the proportion of the CD14⁺CD16⁺ positive cells. This modulatory effect of fatty acids on a subset of monocytes, reportedly expanded in several chronic inflammatory disorders, suggests a further mechanism by which dietary fatty acids ameliorate inflammatory disorders.

Bruunsgaard H, Skinhoj, Pedersen AN, Schroll M & Pedersen BK (2000) *Clinical and Experimental Immunology* **121**, 255–260.

Endres S, Ghorbani R, Kelley VE, Georgilis K, Lonnemann G, van der Meer JWM, Cannon JG, Rogers TS, Klempner MS, Weber PC, Schaefer EJ, Wolff SM & Dinarello CA (1989) *New England Journal of Medicine* **320**, 265–271.

Feldmann M, Brennan FM & Maini RN (1996) *Annual Review of Immunology* **14**, 397–440.

Nockher WA & Scherlich JE (1998) *Infection and Immunity* **66**, 2782–2790.

Reported intakes and assessment of iron and folate stores among Dublin schoolchildren. By A.C. GRIFFIN¹, M.A.T. FLYNN² and K.M. YOUNGER¹. ¹Department of Biological Sciences, Dublin Institute of Technology, Kevin Street, Dublin 8, Republic of Ireland and ²Calgary Regional Health Authority, Alberta, Canada

A deficiency of iron or folate in childhood has adverse effects on mental performance, physical growth and has future implications in the development of coronary heart disease, various cancers and perinatal morbidity and mortality (McNulty, 1995; Cook, 1999). To date there have been no studies that report the iron and folate status or reported intakes among 11- and 12-year-old Irish children. Nutrient intakes were estimated as the mean daily intake (using food atlas and household measures) from foods recorded in two 2 d food diaries by 239 Dublin schoolchildren (110 boys, 129 girls, mean age 11 years) and, in a 1-year follow-up, by 185 of these children (79 boys, 106 girls, mean age 12 years). A measurement of nutrient stores was obtained by analysis of capillary blood samples where a low and borderline iron store was determined as a serum ferritin (SF) concentration <12 µg/l and 12–20 µg/l and a low and borderline folate store as a red cell folate (RCF) concentration <100 µg/l and 100–150 µg/l, respectively (Saubertlich *et al.* 1974; Dallman, 1977).

At both age 11 and 12 years, the proportion reporting daily consumption of important food sources for iron and folate was generally low: 30% (n 72) and 23% (n 43) ate red meat; 21% (n 50) and 15% (n 28) ate dark green leafy vegetables; and 22% (n 53) and 16% (n 30) ate citrus fruit. A comparison with the estimated average requirement (EAR; DoH, 1991) found that, among 11-year-olds, 43% (n 47) boys and 85% (n 109) girls for iron ($P \leq 0.05$) and 29% (n 32) boys and 34% (n 44) of girls for folate reported intakes below the EAR. At age 12 years, 35% (n 28) boys and 83% (n 88) girls for iron ($P \leq 0.05$) and 27% (n 21) boys and 47% (n 50) girls for folate ($P \leq 0.05$) reported intakes less than the EAR.

Low and borderline iron stores were found in 7% (n 14) and 18% (n 34) of 11-year-old subjects, respectively, comparable between the sexes. Of the 12-year-olds, girls were more likely than boys to have low iron stores (15% (n 12) v. 3% (n 2), $P=0.054$), whereas distribution between the sexes was comparable among the 12% (n 17) found to have borderline iron stores. Low and borderline folate stores were found among 1% (n 1) and 1% (n 1) of 11-year-olds (both girls) and, at age 12 years, all the children had sufficient folate stores. Correlations between food sources and haematological parameters were weak, but among the strongest was a positive association ($P \leq 0.05$) at 11 years between SF and haem iron ($r=0.249$) among boys, and meat, fish and poultry among girls ($r=0.280$); whereas RCF was found to positively correlate with the number of meals eaten per day ($r=0.240$) among boys, and to fortified breakfast cereal intake ($r=0.247$) among girls. At age 12 years, negative correlations ($P \leq 0.05$) were found between SF and number of snacks per day ($r=-0.367$) among boys, and calcium ($r=-0.280$) among girls, whereas RCF was found to negatively correlate with Southgate fibre ($r=-0.296$) among boys, and percentage fat ($r=-0.413$) among girls. The positive association between RCF and fortified breakfast cereal was repeated among girls at age 12 ($r=0.428$).

The percentage of subjects with low tissue stores of iron and folate was fewer than expected given the low reported intakes of these nutrients. The assessment of actual tissue stores of nutrients is preferable to estimates of intake in assessing nutrient status and confirmed that the majority of Irish children probably consume adequate amounts of iron and folate. These probably were not accounted for by the dietary recording method because of the known variability in micronutrient intake among children (Livingstone & Robson, 2000). Nevertheless, quality of diet on a day-to-day basis appears poor and requires improving if future chronic diseases are to be avoided.

Cook JD (1990) *Proceedings of the Nutrition Society* **58**, 489–495.
Dallman PR (1977) *Journal of Paediatrics* **90**, 678–681.
Department of Health (1991) *Dietary Reference Values for Food and Energy and for the United Kingdom*. London: HMSO.
Livingstone MBE & Robson PJ (2000) *Proceedings of the Nutrition Society* **59**, 279–293.
McNulty H (1995) *British Journal of Biomedical Science* **52**, 110–119.

Evaluation of dipeptidyl peptidase-IV in type 2 diabetic patients under different glycaemic control. By N. DUFFY¹, A.M. McKillop¹, J.R. LINDSEY², F.P.M. O'HARTE¹, P.M. BELL² and P.R. FLATT¹. ¹School of Biomedical Sciences, University of Ulster, Coleraine and ²Regional Centre for Endocrinology and Diabetes, Royal Victoria Hospital, Belfast

Dipeptidyl peptidase (DPP-IV; CD26; EC 3.4.14.5) located in the endothelial cells and blood can rapidly metabolize insulinotropic hormones such as glucagon-like peptide-1(7-36)amide and gastric inhibitory polypeptide (GIP) by removing dipeptides from the N-terminus, provided that proline or alanine are the penultimate N-terminus residues (Mentlein, 1988). This study was performed to investigate the circulating of DPP-IV activity in type 2 diabetic subjects with regard to activity of the enteroinsular axis and the development of novel peptide diabetic therapies.

Non-fasting blood samples were collected at mid-morning diabetic clinics from fifty-four type 2 diabetic patients in three main categories: twenty-five patients (13 male and 12 female; aged 53–76 years) with good glycaemic control (HbA1c <7%, upper limit of non-diabetic range), nineteen patients (8 male and 11 female; aged 38–81 years) with moderate glycaemic control (HbA1c 7–9%) and ten patients (6 male and 4 female; aged 57–81 years) with poor glycaemic control (HbA1c >9%). Seventy age- and sex-matched non-diabetic subjects were used as controls (HbA1c <6%). Samples were analysed for DPP-IV, HbA1c, glucose and insulin concentrations.

	HbA1c (%)	Glucose (mmol/l)	Insulin (mIU/l)	DPP-IV (nmol/ml/min)
Healthy Controls	5.9 ± 0.01	5.5 ± 0.02	30.2 ± 4.0	22.5 ± 0.7
Type 2 Diabetics				
Good	6.4 ± 0.1 ***	8.4 ± 0.4 ***	41.5 ± 7.6	18.7 ± 1.0 **
Moderate	7.9 ± 0.1 ***	11.4 ± 0.8 ***	27.5 ± 3.7	17.4 ± 1.4 **
Poor	9.9 ± 0.2 ***	14.4 ± 1.1 ***	34.3 ± 12.0	18.0 ± 1.5 *

Significant differences are indicated by *** $P < 0.001$, ** $P < 0.01$ and * $P < 0.05$

These results suggest that plasma DPP-IV activity may be affected by the degree of diabetic glycaemic control. As DPP-IV activity is reduced in diabetes, this may be a mode of action to potentiate levels of GLP-1 action on gastric emptying, satiety and plasma insulin concentrations in type 2 diabetes.

Mentlein R (1988) *FEBS Letters* **234**, 251–256.

Ascorbic acid supplementation reduces blood pressure and arterial stiffness in patients with type 2 diabetes. By I.S. YOUNG¹, B.A. MULLAN^{1,2} and D.R. McCANCE², ¹Department of Medicine, Queen's University Belfast, Belfast BT12 6BJ and ²Regional Metabolic Unit, Royal Group of Hospitals, Belfast BT12 6BA

Experimental evidence suggests that acute parenteral administration of high-dose ascorbic acid has beneficial vascular effects in type 2 diabetes. However, there is little information about haemodynamic effects of chronic oral supplementation with ascorbic acid in this condition. The aim of this study was therefore to determine the effects of oral ascorbic acid (500 mg/day) or placebo in type 2 diabetes.

Thirty patients, aged 45–70 years, with type 2 diabetes (duration < 10 yrs) (HbA1c mean (SD) 8.1 (1.0) %) were randomized in a double-blind manner to ascorbic acid 500 mg daily or placebo. Patients were studied at baseline and after 4 weeks of assigned treatment. The central aortic augmentation index (Agx) and the time to wave reflection (Tr) were derived from radial artery pulse wave analysis data. Agx and Tr were used as measures of systemic arterial stiffness and aortic stiffness, respectively (Wilkinson *et al.* 1998; Marchais *et al.* 1993).

Ascorbic acid decreased mean (SD) brachial systolic blood pressure from 142.1 (12.6) to 132.3 (12.1) mmHg (difference (95% CI) 9.9 (4.7, 15.0); $P < 0.01$), brachial diastolic pressure from 83.9 (4.8) to 79.5 (6.0) mmHg (4.4 (1.8, 7.0); $P < 0.01$) and Agx from 26.8 (5.5) to 22.5 (6.8)% (4.3 (1.5, 7.1); $P < 0.01$). Tr increased from 137.1 (12.6) to 143.4 (9.2) ms (–6.3 (–10.1, –2.5); $P < 0.01$). The placebo had no haemodynamic effects and this difference between treatments was significant ($P < 0.01$ for blood pressure and Tr, $P = 0.03$ for Agx).

Ascorbic acid, 500 mg daily, lowered blood pressure and improved arterial stiffness in patients with type 2 diabetes. Strict control of blood pressure has been shown to reduce cardiovascular risk in this condition. Oral ascorbic acid supplementation may be a useful and inexpensive adjunct therapy in type 2 diabetes.

	Placebo		Ascorbic acid		ANOVA P value
	Baseline	One month	Baseline	One month	
Systolic bp (mmHg)	142.7 ± 11.7	141.7 ± 11.8	142.1 ± 12.6	132.1 ± 12.1†	<0.01
Diastolic bp (mmHg)	85.1 ± 6.4	85.7 ± 6.1	83. ± 4.8	79.5 ± 6.0	<0.01
Agx (%)	28.0 ± 7.4	27.5 ± 6.7	26.8 ± 5.5	22.5 ± 6.8†	0.026
Tr (ms)	138.5 ± 10.2	138.1 ± 8.9	137.1 ± 12.6	143.4 ± 9.2†	<0.01
Difference (95% CI)					
Systolic bp					9.9 (4.7, 15.0)
Diastolic bp					4.4 (1.8, 7.0)
Agx					4.3 (1.5, 7.1)
Tr					–6.3 (–10.1, –2.5)

Wilkinson IB, Cockcroft JR, Webb DJ (1998) *Journal of Cardiovascular Pharmacology* **32** Suppl. 3, S33–S37.
Marchais SJ, Guerin AP, Pannier BM, Levy BI, Safar ME, London GM (1993) *Hypertension* **22**, 876–883.

Plasma homocysteine is not related to aortic pulse wave velocity in healthy young adults. By J.V. WOODSIDE¹, A. M. GALLAGHER², C.A. BOREHAM², L.J. MURRAY¹, J.J. STRAIN³, H. MCNULTY³, P.J. ROBSON³, M. SAVAGE¹ and I.S. YOUNG¹, ¹School of Clinical Medicine, Queen's University Belfast, Belfast BT12 6BJ, ²School of Applied Medical Sciences and Sports Studies, University of Ulster, Jordanstown, BT37 0QB and ³Northern Ireland Centre for Diet and Health, University of Ulster, Coleraine BT52 1SA

Hyperhomocysteinaemia has been associated with alterations in vascular structure and cardiovascular disease. In particular, high plasma homocysteine (tHcy) concentrations have been shown to be associated with reduced pulse wave velocity (pwv) in patients with end-stage renal disease (Blacher *et al.* 1998) and in those with hypertension (Bortolotto *et al.* 1999). The aim of this study was to examine the association between tHcy concentrations and pwv in healthy young adults.

The study was conducted as part of an ongoing longitudinal study, the Young Hearts Project, which initially examined the prevalence of coronary risk factors of young people ($n=1015$; aged 12 years and 15 years) in Northern Ireland. All subjects in the original cohort were invited to participate in the third screening phase when aged between 20 and 25 years. A total of 489 subjects accepted the invitation to attend (response rate=48.2%). A fasting blood sample was taken and tHcy was measured by high performance liquid chromatography according to Ubbink *et al.* (1991). Pulse wave velocity was measured using a non-invasive optical method (Martyn *et al.* 1995) in three arterial segments – the aorto-iliac segment, the aorto-radial segment and the aorto-dorsalis-pedis segment.

tHcy did not correlate with pwv, whether assessed at the aorto-iliac segment ($r=0.069$, $P=0.18$, $n=389$), the aorto-radial segment ($r=0.044$, $P=0.39$, $n=394$) or the aorto-dorsalis-pedis segment ($r=0.062$, $P=0.22$, $n=395$). When tHcy was classified into normal (<15 µmol/l) and high (≥15 µmol/l), pwv did not differ between the two groups (aorto-iliac, normal tHcy 3.09 (0.44) v. high tHcy 3.09 (0.52), $P=NS$; aorto-radial, normal tHcy 4.24 (0.54) v. high tHcy 4.23 (0.52), $P=NS$; aorto-dorsalis-pedis, normal tHcy 4.98 (0.57) v. high tHcy 4.90 (0.57), $P=NS$; Mean (SD)). Considering aortic pwv as a dependent variable, multistep regression analysis for each segment showed that the only parameters entering the model were BMI (aorto-iliac segment only $\beta=0.17$, $P=0.01$), and systolic blood pressure (aorto-iliac $\beta=0.43$, $P<0.001$; aorto-radial $\beta=0.24$, $P=0.01$; aorto-dorsalis-pedis $\beta=0.28$, $P=0.001$). None of the other parameters, including age, sex, tHcy, cobalamin, folate, glucose, total cholesterol, HDL-cholesterol, triacylglycerol or fibrinogen, significantly entered the model for any segment. This study shows that arterial pwv is not associated with tHcy concentrations in a healthy young population.

Blacher J, Demuth K, Guerin AP, Safar ME, Moatti N & London GM (1998) *Arteriosclerosis Thrombosis and Vascular Biology* **18**, 535–541.
Bortolotto LA, Safar ME, Billaud E, Lacroix C, Asmar R, London GM & Blacher J (1999) *Hypertension* **34**, 837–842.
Martyn CN, Barker DJP, Jespersen S, Greenwood S, Osmond C & Berry C (1995) *British Heart Journal* **73**, 116–121.
Ubbink JB, Vermaak WJH & Bisschop S (1991) *Journal of Chromatography* **565**, 441–446.

Nutritional intakes of Qatari women during and after Ramadan. By A. AL-ROMAHI^{1,2}, M. MOLOONEY² and E.P. MCNAMARA², ¹University of Dublin, Trinity College, Dublin 2, Republic of Ireland and ²Dublin Institute of Technology, Kevin Street, Dublin 8, Republic of Ireland

The diet in the Middle East has changed dramatically over the last few decades and is fast becoming more “westernised” (Miladi, 1998). Only limited food intake studies have been conducted in Qatar (Davidson, 1979), despite the fact that the prevalence of obesity is 62.6% in Qatari women (Musaiger *et al.*, 1998).

The aim of this non-randomized, prospective dietary survey was to assess differences in the nutritional content of a Ramadan diet and the diet during non-Ramadan times. Weight and physical activity levels during Ramadan and at normal times were also investigated. Thirty-two healthy Qatari women (aged 25–48 years) were recruited from colleges, Ministry of Education offices, teaching facilities and other government buildings in Doha. Subjects were asked to complete a 3 d food diary both during and after Ramadan. Subjects were visited regularly during the study period to ensure correct completion of the diaries. Four of the women did not complete diaries after Ramadan and were excluded from the analysis. Weights were taken initially and at the end of the study. All subjects completed a physical activity questionnaire adapted for Qatari women.

Three subjects lost weight after Ramadan, thirteen gained weight (average gain 1.7 kg) and twelve remained the same weight. Mean weight for both periods was high (77.1 kg during, and 77.6 kg after Ramadan). After Ramadan, 43% of the subjects were obese or morbidly obese (BMI >30 kg/m²), 36% were overweight (BMI >25 kg/m²) and 21% were normal or underweight (BMI <24.9 kg/m²).

Macro- and micronutrient intake increased significantly after Ramadan. Mean energy intake during Ramadan was 6.7 MJ (1585 kcal)/d, while afterwards it increased to 8.2 MJ (1959 kcal)/d. Intakes of calcium, folate, starch, and fibre intake significantly decreased during Ramadan. Physical activity increased after Ramadan, but little activity was undertaken during either period, e.g. walking at any pace was 3.2 h per week during and 4.1 h per week after Ramadan. Time spent watching television per week (17 h during and 18.3 h after Ramadan) were similar to Irish data (Livingstone *et al.*, 2001).

	Units	During Ramadan*	After Ramadan*	P value
Energy	MJ	6.67 (2.6)	8.23 (3.3)	0.018
	Kcal	1584.7 (608.5)	1958.8 (787.1)	0.018
Protein	(g)	57.9 (21.5)	79.5 (29.6)	0.001
	(% energy)	14.9 (4.1)	16.7 (3.2)	0.096
Carbohydrate	(g)	200.2 (95.7)	243.3 (113.1)	0.094
	(% energy)	46.2 (6.9)	45.9 (8.7)	0.982
Fat - Total	(g)	67.3 (24)	81.1 (36.5)	0.065
	(% energy)	39.1 (7.2)	37.5 (7.6)	0.509
SFA	(g)	20.6 (10.5)	27.9 (15.1)	0.023
MCFA	(g)	21.6 (6.9)	28.4 (13.1)	0.003
PUFA	(g)	13.2 (5.7)	14.6 (7.3)	0.350
Number of eating occasions	Eating occasions/day	3.0 (0.7)	4.4 (1)	0.000

*Results expressed as means (SD).

Overall the diet of women during Ramadan was low in energy and some micronutrients. Special foods (consumed only during Ramadan), altered intakes of certain nutrients such as calcium, starch and fibre. Similar to other studies, the sample had a low physical activity level, which may have contributed to the increase in obesity in the region (Miladi, 1998; Musaiger *et al.*, 1998).

Davidson JC (1979) *British Medical Journal* **8**, 1511–1512.
Miladi SS (1998) *International Journal of Food Science and Nutrition* **49**, S23–S30.
Musaiger AO, Al-Khalaf FA & Shahbeek NE (1998) *International Journal of Food Science and Nutrition* **49**, S53–S57.
Livingstone MB, Robson PJ, McCarthy S, Kiely M, Harrington K, Browne P, Galvin M, Wareham NJ & Rennie KL (2001) *Public Health Nutrition* **5A**, 1107–1116.

Identification of twenty-six risk factors affecting nutritional intake and a mini nutritional assessment of patients in a long-stay psychiatric hospital. By M. O'DONNELL¹, M. MCNICHOLAS² and P. FINEGAN³, ¹Community Nutrition and Dietetic Service, Western Health Board, Galway, Republic of Ireland, ²Consultant Dietitian, Westport, Co. Mayo, Republic of Ireland and ³St Mary's Hospital, Castlebar, Co. Mayo, Republic of Ireland

Concerns about malnutrition in the elderly hospitalized population have been well documented, highlighting the subsequent effects on delayed recovery, increased complications and increased mortality rate (Department of Health & Children and National Council on Ageing and Older People, 1998). A wide spectrum of factors influences nutritional status (Mackintosh & Hankey, 2001). Adequate nutrition is especially necessary in older people.

There is a higher than average population of older people, aged sixty-five and over, aged 65 years and over, living within the Western Health Board (WHB) at 14% compared with the national average of 11%. The WHB has developed a strategy to promote the health and well-being of older people. Currently there are no specialist psychiatry services for older people in the Western Board and the needs of those with acute functional psychiatric disturbances are catered for by the general adult psychiatric services (WHB, 2001). Meals provided in long-stay units must be nutritionally adequate to meet the needs of the older patient with mental illness, as the symptoms of the illness can have an influence on nutritional status. The Community Nutrition and Dietetic Service completed a nutrition and catering assessment of a long-stay psychiatric hospital, total population one hundred and thirty-six patients in order to assess the status of twenty-six risk factors previously identified by Davies and Holdsworth (1979) as affecting nutritional intake. A validated Mini Nutritional Assessment was completed on a random sample of twenty-one residents (15% *n*) to assess their nutritional status (Guigoz *et al.*, 1994). Each patient had an anthropometric, dietary, and general self-assessment form completed from which a malnutrition indicator score was established. Meal patterns and menu cycles were reviewed. Costings were completed to establish actual cost of food ingredients per patient per week.

Assessment of 26 identified risk factors	
26 identified risk factors 5 identified as high risk	• supper meal before 5pm
	• poor presentation of food
11 identified as moderate risk 10 identified as low risk	• few vitamin D foods and lack of exposure to sunlight
	• lack of Vitamin C rich foods
	• possible low intake of iron, folate
Mini nutritional assessment	
Sample size	<i>n</i> 21 15
Male	12 57
Female	9 43
Risk of malnutrition	17 80
Well nourished	2 10
Malnourished	2 10

The main contributing factors to those malnourished were low body mass index, <25, need assistance with feeding, calf circumference <31 cm, more than three prescription drugs daily, confined indoors, and fewer than two fruits and vegetables consumed daily. Ingredients were costed at 20.5 euros (£16.10 punt) per patient weekly. Other research has identified inadequate energy intake in as many as 50% of mentally ill patients in residential hospitals. Results indicated that adequate energy and protein intakes are of paramount importance to this population in order to prevent weight loss. Recommendations that the timing of meals and snacks be changed, and a 4-weekly menu cycle be developed to include a choice of meals. Finger foods and textured soft diet to assist slow eaters and improve self-esteem were also recommended. To date, a steering committee has implemented the above recommendations and ongoing monitoring is being completed.

Department of Health & Children and National Council on Ageing and Older People (1998) *A Health Promoting Strategy for Older People: Adding Years to Life, Life to Years*. Dublin, Ireland.
Guigoz Y, Velaz B & Garry PG (1994) *Facts and Research into Gerontology, Supplement* **2**, 15–59.
Mackintosh MA & Hankey CR (2001) *Journal of Human Nutrition and Dietetics* **14**, 129–135.
Western Health Board (2001) *Services for Older People: A Strategy for Health and Well-being 2001–2005*. Galway, Ireland.
Davies L & Holdsworth MD (1979) *Journal of Human Nutrition* **33**, 165–169

Irish dietitians' views on tube feeding. By S. HEALY^{1,2} and E.P. McNAMARA² ¹*University of Dublin, Trinity College, Dublin 2, Republic of Ireland* and ²*Department of Biological Sciences, Kevin Street, Dublin 8, Republic of Ireland*

Long-term tube feeding is fast becoming a normal part of the management of certain patient types; however, in some cases its proposed use is controversial. In the majority of cases the decision to initiate, continue, withhold or withdraw feeding is made relatively easily, but in an increasing number of cases the decision poses an ethical, legal, moral, professional and personal dilemma for all those involved (Ravenscroft & Bell, 2000). Ideally, decisions should be made on the basis of clearly set goals of treatment. Few studies have, however, looked at dietitians' views regarding this area of care.

A postal questionnaire was designed to first establish the experience of dietitians in caring for these potentially problematic patients. Secondly we wished to assess dietitians' views on tube feeding both for themselves and for patients with end-stage dementia, persistent vegetative state (PVS), terminal cancer and stroke. Thirdly, the level of communication between family and health care professional was examined. Lastly, knowledge of tube feeding in relation to survival in patients with end-stage dementia was investigated. The questionnaire was sent out to 345 members of the Irish Nutrition and Dietetic Institute working in various areas of dietetic practice. A response rate of 45% was achieved.

A large percentage of dietitians were involved in initiating tube feeding in stroke patients (81%). A surprisingly high number (24%) were involved in initiating tube feeding in PVS patients. There was found to be a significant relationship ($P < 0.01$) between what each dietitian would choose for themselves in terms of tube feeding and how they decided to treat their patients in each of the four states of ill health (end-stage dementia, PVS, terminal cancer, stroke). However, dietitians were more likely to want tube feeding for the patient than for themselves if they were in the same situation. The majority of respondents felt that the information given to families (or decision-makers) of patients with end-stage dementia concerning tube feeding was inadequate (67%); however, 24% said they had not discussed either initiation or discontinuation of tube feeding with the family of the last patient they were involved with. The majority of dietitians also felt that the discussion and communication amongst the medical team regarding tube feeding the patient with end-stage dementia was inadequate (58%). Of the dietitians, 43% were unsure whether tube feeding improves survival rates in dementia patients, 35% thought that it did while the rest didn't think it improved survival rates in this group.

	Stroke		Dementia		Terminal Cancer		PVS	
	Patient [†]	Dietitian [‡]	Patient [†]	Dietitian [‡]	Patient [†]	Dietitian [‡]	Patient [†]	Dietitian [‡]
In favour	82	74	49	18	77	36	48	16
Opposed	14	8	50	69	21	50	47	73
Undecided	4	18	1	13	3	14	5	11
Total	100	100	100	100	101	100	100	100

[†] Dietitian choosing whether or not to tube feed the patient.

[‡] Dietitian choosing whether or not to tube feed themselves in the same scenario.

The study highlights the differences in how dietitians wish to be treated and how they treat their patients. Recognizing this fact and understanding what influences their decisions may improve decision-making and communication between patient, family and health professionals. It also highlights the need for continued discussion among dietitians regarding tube feeding and the importance of establishing guidelines to aid dietitians in this area.

Ravenscroft AJ & Bell D (2000) *Journal of Medical Ethics* **26**, 435–440.

Setting up a peer-led nutrition education program in a rural setting: identifying the pitfalls and strengths. By Gray, Cara¹, Marguerite Clancy², *Community Nutrition and Dietetics Service, Midland Health Board, Pearse House, 28 Pearse Street, Mullingar, Co. Westmeath¹, Department of Clinical Audit and Research, Midland Health Board, Tullamore*

People on a lower income have long been shown to have poorer diets, which lead to a higher risk of developing health problems (James *et al.* 1997). The constraints of being on a tight budget have been shown to have a negative impact on changes to diets; most are unwilling to change eating patterns and there is less opportunity for experimentation with diets (Dowler *et al.* 1997).

The Food and Health project was set up in 1999; it represents a new approach to nutrition education for those cooking on a budget. It seeks to raise awareness of good nutrition among disadvantaged groups. The program was initially developed by the Department of Health and Children and piloted in an urban setting. This is the first application of the program in a rural location. This project is a joint initiative between the Athlone Community Taskforce (ACT) and the Midland Health Board (MHB).

A good working relationship has been developed between the Community Nutrition and Dietetic Service (MHB) and ACT, with a local coordinator being appointed by ACT to oversee the smooth running of the project. The project commenced with the recruitment and training of local people to become peer facilitators, known as Food and Health instructors. Once trained the project liaised with community groups in order to match groups with Food and Health instructors from throughout the region. Fifty-seven community courses have been completed. A wide and diverse variety of groups have availed of the community course these groups include mother and toddler groups, men's groups, parent support associations and active age groups.

Since it was established many lessons have been learnt. The partnership between ACT and the Midland Health Board remains very strong. Each partner contributes qualities, which are essential to the project. Good communication is the key, as intention to collaborate will not suffice (Leathard, 1999). Differences have arisen especially within the expectation of what the project hoped to achieve; ACT looked at the project from a job creation point of view whereas the MHB was more interested in the Health promoting influences the project would have. Both views have proved compatible in this case.

The area of Community Development and Nutrition Education is a relatively new area. The Food and Health project is progressing well. Peer-led nutrition education appears to be the way forward as it provides a safe environment for experimentation with healthy food. Further evaluation is ongoing, especially in the area of measuring behavioural changes in communities, which have undertaken the programme.

Dowler EA & Dobson BM (1997) *Proceedings of the Nutrition Society* **56**, 51–62.

James WPT, Nelson M, Ralph A & Leather S (1997) *British Medical Journal* **314**, 1545.

Leathard A (1999) Collaboration: united we stand, divided we fall? In *The Challenge of Promoting Health: Exploration and Action*, [J Jones and M Suddell, editors].

Energy and protein intakes, and subjective global assessment of peritoneal dialysis patients. By O. GRIFFIN¹, G. HOULIHAN² and M. MOLONEY¹. ¹*Department of Clinical Medicine, Trinity Centre for Health Sciences, St. James Hospital, Dublin 8, Republic of Ireland and* ²*Department of Clinical Nutrition and Dietetics, Beaumont Hospital, Dublin 9, Republic of Ireland*

Protein energy malnutrition (PEM) is a complication seen in 18–70% of patients undergoing renal replacement therapy (Kopple, 1999), and has been associated with increased mortality and morbidity. Conventional methods of nutritional assessment are limited in patients undergoing peritoneal dialysis (PD) (Chumlea, 1997). Subjective global assessment (SGA) has been validated for use in patients undergoing renal replacement therapy (McCann, 1996; K/DOQI, 2000). Current Irish energy and protein guidelines for peritoneal dialysis patients are less than the recently published American guidelines (K/DOQI, 2000).

Twenty peritoneal dialysis patients attending for outpatient review at Beaumont Hospital, Dublin, over a 2-month period were recruited. Nutritional status was evaluated using subjective global assessment. Dietary intake was assessed using 3 d food diaries, and analysed using the weighed intake analysis software V1.2. Results were entered into SPSS for statistical analysis, version 10.00.

Following analysis, 50% of the subjects were classified as mild/moderately malnourished, while none were found to be severely malnourished. A significant difference in mean energy intake was seen between continuous ambulatory peritoneal dialysis (CAPD) and continuous cyclical peritoneal dialysis (CCPD) patients classified according to the SGA rating system ($P<0.01$ and $P<0.05$). Mildly malnourished CAPD patients had higher protein intakes than mildly malnourished CCPD subjects ($P<0.05$). It was also found that 25% of patients had energy intakes less than the guidelines, while 60% of patients were not meeting the protein recommendations.

INDI Renal Interest Group Guidelines (1998)	PD (n 20)	CAPD (n 9)	CCPD (n 11)
Energy: Kcal/kg IBW/ day	30.33	34.17	27.31
25–35			
Protein: g/kg IBW/day	1.13	1.21	1.06
1.2–1.5			
% High Biological Value Protein	70.9	69.64	71.9
70–75%			

This study shows a mild/moderate degree of PEM is common among PD patients in Ireland. SGA appears to be effective in identifying malnutrition in PD patients but not a sole indicator of nutritional status. Current INDI-RIG recommendations would seem appropriate in preventing PEM in PD patients. Methods of preventing and correcting PEM in peritoneal dialysis patients need to be identified.

Chumlea WC (1997) *Journal of Renal Nutrition* **7**, 176–181.
INDI Renal Interest Group Guidelines (1998) Dietary Guidelines on patients on CAPD.
K/DOQI (Kidney Disease Outcome Quality Initiative) National Kidney Foundation (2000) *American Journal of Kidney Diseases* **35**, Supplement 2.
Kopple JD (1999) *American Journal of Kidney Diseases* **33**, 180–185.
McCann L (1996) *Dialysis and Transplantation* **25**, 190–202.

Protein and energy intakes and subjective global assessment of haemodialysis patients. By O. SLEVIN¹, G. HOULIHAN² and M. MALONEY¹. ¹*Department of Clinical Medicine, Trinity Centre for Health Sciences, St. James Hospital, Dublin 8, Republic of Ireland and* ²*Department of Clinical Nutrition and Dietetics, Beaumont Hospital, Beaumont, Dublin 9, Republic of Ireland*

Malnutrition is common in maintenance dialysis patients, irrespective of whether they are treated with haemodialysis or peritoneal dialysis, and is strongly associated with increased morbidity and mortality (Lindholm *et al.* 1998). The causes of protein-energy malnutrition are multifactorial and include decreased protein and energy intakes, primary illnesses, endocrine and metabolic disorders and dialysis-related events (Laville & Fouque, 2000). The use of subjective global assessment (SGA) has been validated for use in haemodialysis patients, and is a clinically useful measure of protein-energy nutritional status in maintenance dialysis patients (K/DOQI, 2000).

Thirty haemodialysis patients were recruited from a day-ward in Beaumont Hospital, Dublin. The inclusion criteria were that the patient must have been between 18 and 80 years of age, on the haemodialysis programme for longer than 6 months, and free from any illness at the time of the study.

Subjective global assessment was performed on all patients, and patients were ranked as either well nourished, mildly, moderately, or severely malnourished. All patients completed a 3 day food diary and a food frequency questionnaire and were interviewed on three separate occasions, where a photographic food atlas was used to determine food quantities, from the food diaries. This information was then analysed using the WISP software programme V1.2 and the data were analysed statistically using SPSS version 10. (SPSS, Chicago, IL).

Of the thirty patients studied, 46% were well nourished, 27% were mildly malnourished and 27% were moderately malnourished. No patients were found to be severely malnourished. Energy and protein intakes were found to be significantly and inversely correlated to subjective global assessment, ($P<0.001$ and $P<0.0001$, respectively). Thus as energy and protein intakes decreased, the degree of malnutrition increased. A high percentage failed to achieve the current Irish recommendations for energy (69%) and protein (34%). (INDI Renal Interest Group Recommendations, 1998).

The study demonstrated that there is a high prevalence of maintenance haemodialysis patients with a mild or moderate degree of protein-energy malnutrition. Subjective global assessment is a sensitive and acceptable tool for screening this patient group.

	Actual Nutrient Intakes of Haemodialysis patients (n 30)	Recommended Intakes as per INDI Renal Interest Group
Energy (kcal/kg IBW)	26.4 +/- 7.07	35
Protein g/kg IBW	1.165 +/- 0.67	1–1.2
% High Biological Value Protein	68.4 +/- 8.7	70–75

Irish Nutrition and Dietetic Institute (INDI) Renal Interest Group Recommendations for Haemodialysis Patients (Care Plan 1998)
K/DOQI (Kidney Disease Outcome Quality Initiative): National Kidney Foundation (2000) *American Journal of Kidney Diseases* **35**, Suppl. 2, S1–S122.
Laville M & Fouque D (2000) *Kidney International* **58**, Suppl. 76, S133–S139.
Lindholm B, Wang T, Heimburger O & Bergstrom F (1998) *Nephrology Dialysis Transplantation* **13**, 66–73.

Content of the phyosterols β -sitosterol, campesterol and stigmasterol in commercially available vegetable oils. By D.M. FAHY, K. GALVIN and N.M. O'BRIEN, *Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

Phyosterols are components of the plant cell membrane and are structurally similar to cholesterol. In the diet, phyosterols are found in a range of nuts, seeds, vegetables and vegetable oils with daily dietary intakes ranging around 200–500 mg/d. Phyosterols are known to have a wide range of biological activities. Hypocholesterolaemic activities of some phyosterols have been documented (Westrate & Meiger, 1998) and their esters have been suggested as effective cholesterol-lowering agents, offering heart health benefits (Law, 2000).

About 250 different sterols have been separated in plants, of which the three most abundant are β -sitosterol, campesterol and stigmasterol. However, there is a paucity of data available on the content of phyosterols from plant sources, which is very variable. Plant phyosterol contents may vary depending on region and country. The increasing public interest in the cholesterol-reducing capacity of phyosterols has provided an impetus to reviewing existing methods for the analysis of sterols in samples, with an emphasis on vegetable oils. The aim of the present study, therefore, was to investigate and optimize methodology for the extraction and subsequent determination of selected phyosterols in seven commercially available vegetable oils.

Phyosterols were extracted from vegetable oils by a modification of the method of Buttriss & Diplock (1984), utilizing a C18 Supulco® and a flow rate of 1.2 ml/min. Extracts were re-dissolved in ethanol and analysed by reverse phase HPLC (99%MeOH: 1% H_2O).

	β -Sitosterol		Campesterol		Stigmasterol	
	(mg/ml)	SD	(mg/ml)	SD	(mg/ml)	SD
Olive oil	1.54	0.10	0.47	0.11	0.11	0.03
XV Olive oil	1.26	0.02	0.71	0.01	0.04	0.01
Walnut oil	1.75	0.01	0.26	0.04	0.09	0.01
Sunflower oil	2.36	0.21	1.02	0.14	0.17	0.02
Corn oil	2.98	0.83	1.17	0.27	0.19	0.02
Sesame seed oil	1.77	0.60	0.68	0.22	0.12	0.04
Soyabean oil	0.58	0.45	0.30	0.21	0.11	0.04

n = 2 independent experiments. XV olive oil = Extra virgin olive oil.

The content of the three phyosterols; β -sitosterol, campesterol and stigmasterol, varied greatly in the oils tested. As expected, β -sitosterol was the major phyosterol present in all samples, with corn oil and sunflower oils containing the highest amounts. Both these oils were also good sources of campesterol. Sesame, walnut and the two olive oils all contained similar levels of the phyosterols, whereas soyabean oil was a poor source. Overall, the sum of the phyosterols varied between 0.99 mg/ml (soyabean oil) to 4.34 mg/ml (corn oil) in the samples analysed.

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Buttriss JL & Diplock AT (1984) *Methods in Enzymology* **105**, 131–138.

Law M (2000) *British Medical Journal* **320**, 861–864.

Westrate J & Meiger G (1998) *European Journal of Clinical Nutrition* **52**, 334–343.

Modulatory effects of α - and γ -tocopherol on oxysterol-induced cytotoxicity in two human cell lines. By A.J. O'SULLIVAN and N.M. O'BRIEN, *Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

In Western-style diets, γ -tocopherol (γ -T) accounts for more than 50% of the total intake of tocopherols (Behrens & Madere, 1986). However, α -tocopherol (α -T) is present at higher concentrations in both plasma and low-density lipoproteins (LDL) and is the more biologically active form of vitamin E (Wolf, 1997). The aim of this study was to assess the ability of α - and γ -T to protect against oxysterol (OS)-induced cytotoxicity. Due to the putative role of oxysterols in the development of atherosclerosis, the research to date has concentrated on vascular cell lines and the toxicity of oxysterols in these cell lines has been well documented. However, there is a limited amount of data on the toxicity of oxysterols to cells of the colon and liver, which represent the initial sites of exposure to dietary oxysterols. The present study, therefore, investigated the potential modulatory effects of tocopherols on the toxicity of four commonly occurring dietary oxysterols in HepG2, a human hepatoma cell line and Caco-2, a human colonic adenocarcinoma cell line.

Caco-2 and HepG2 cells were supplemented with or without α -T and γ -T (100 μM) for 24 h. The tocopherols were removed and cells exposed to increasing concentrations (0–20 $\mu\text{g/ml}$) of 25-hydroxycholesterol (25-OHC), 7 β -hydroxycholesterol (7 β -OHC), cholesterol-5 α ,6 α -epoxide (α -epox) and cholesterol-5 β ,6 β -epoxide (β -epox) for 24 h. Test media were replaced with normal growth media and the cells were allowed to grow for a further 72 h. Cytotoxicity was assessed using the neutral red uptake assay. Concentration of compound that inhibited cell viability by 50% (IC_{50} value) was calculated.

		IC_{50} values ($\mu\text{g/ml}$)					
		25-OHC		7 β -OHC		α -Epox	
		Mean	SE	Mean	SE	Mean	SE
Caco-2	OS only	3.3	0.2	8.6	0.7	10.4	0.9
	OS + α -T	2.6	0.5	8.0	0.8	6.9	0.3
HepG2	OS + γ -T	0.6	0.1	5.1	0.9	3.9	0.2
	OS only	5.6	0.7	>20	–	12.8	1.1
	OS + α -T	5.0	0.6	>20	–	17.9	0.3
<i>n</i> = 3 independent experiments.		4.0	0.4	19.1	0.7	13.7	1.4

In Caco-2 cells, pretreatment with α -T did not significantly alter oxysterol-induced cytotoxicity. However, pretreatment with γ -T increased the toxicity of all oxysterols to Caco-2 cells as measured by decreased IC_{50} values. In HepG2 cells, pretreatment with α - or γ -T did not significantly affect the oxysterol-induced cytotoxicity. In summary, under the conditions employed in this study α -T and γ -T failed to protect against the toxicity induced by four commonly found dietary oxysterols, while preincubation with γ -T exacerbated the toxicity of the oxysterols to the Caco-2 cells. In this study, the mechanism of oxysterol-induced cytotoxicity does not appear to be pro-oxidant means.

Behrens WA & Madere R (1986) *Journal of the American College of Nutrition* **5**, 91–96.

Wolf GW (1997) *Nutrition Reviews* **55**, 376–378.

The effect of β -sitosterol oxidation products on cell viability in two human cell lines. By L.S. MAGUIRE, M.A. KONOPLYANNIKOV and N.M. O'BRIEN, *Department of Food Science, Food Technology and Nutrition, University College Cork, Ireland.*

Phytosterols are plant sterols that are similar in structure to cholesterol. Unsaturated phytosterols are subject to oxidation both *in vivo* and *in vitro*. Although research in this area is limited, it does indicate a potential for formation of phytosterol oxides in plant foods (Dutta, 1999). Considerably more work has been reported on oxidation of cholesterol in foods. Several cholesterol oxides have been intensively investigated for their potential harmful effects including cytotoxicity, atherogenicity and interference with cholesterol metabolism. Relatively little information is available on the potency of phytosterol oxides and due to their structural similarity to cholesterol oxides there is a need to assess the possible harmful effects of phytosterol oxides. The aim of this study was to investigate the effects of oxidation products of the phytosterol, β -sitosterol, in Caco-2 cells, a human adenocarcinoma colonic cell line and U937 cells, a human monocytic blood cell line.

β -Sitosterol (β -sit) was oxidized by heating the compound at 100° for 24 h. Thin Layer Chromatography analysis revealed a mixture of oxidation products was produced. U937 cells were maintained in RPMI 1640 and Caco-2 in DMEM media supplemented with 25ml/l fetal calf serum. Cells were treated with β -sit (30 and 60 μ M), increasing concentrations of β -sit oxidation products (β -oxid; 0-120 μ M) or a cholesterol oxide, 7 β -hydroxycholesterol (7 β -OH; 30 μ M) and incubated at 37°, air:CO₂ (95:5). Control cells were treated with an equal volume of ethanol. After 24 h and 48 h cytotoxicity was assessed in Caco-2 cells using the neutral red uptake assay (NRUA), in U937 cells by trypan blue exclusion (TBE) and the results were expressed as percentage viability relative to controls.

Treatment	Caco-2				U937			
	% cell viability (NRUA)		% cell viability (TBE)		24 h		48 h	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Control	100.0		100.0		100.0		100.0	
β -sit (30 μ M)	117.1	9.3	114.2	5.2	97.6	0.8	95.2	0.9
β -sit (60 μ M)	108.7	5.3	101.5	0.5	97.0	0.8	94.9	0.9
β -oxid (30 μ M)	97.6	3.7	99.7	4.2	90.1	1.4	83.7	1.4
β -oxid (60 μ M)	102.8	7.7	84.9	11.4	75.8*	2.0	67.7*	1.7
β -oxid (120 μ M)	83.8	4.4	58.5**	3.5	41.6**	2.3	20.4**	1.5
7 β -OH (30 μ M)	116.2	16.7	77.2	5.7	65.4**	2.3	27.5**	1.6

n $\geq$ 3 independent experiments. *P<0.05, **P<0.001 = significantly different from control cells.

β -Sit was not toxic to either cell type at the concentrations used in this experiment. In Caco-2 cells, β -oxid displayed toxicity but only at the higher concentration (120 μ M) and particularly after 48 h. The cholesterol oxide, 7 β -OH was not significantly toxic to this cell line at the concentration tested (30 μ M). In the U937 cells, β -oxides were much more toxic at both the 24 and 48 h time points. Similarly, 7 β -OH was also more toxic to this cell line. In conclusion, oxidation products of β -sit and 7 β -OH appear to be more toxic to U937 than Caco-2 cells.

Dutta PC (1999) In: *Natural Antioxidants and Anticarcinogens in Nutrition, Health and Disease*. Royal Society of Chemistry, pages 316-319.

The alteration of cellular glutathione content in oxysterol-induced apoptosis. By L. RYAN, Y.C. O'CALLAGHAN and N.M. O'BRIEN, *Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

Glutathione (GSH) is the key regulator of intracellular redox status and has also been shown to become depleted in the early stages of apoptosis. GSH depletion may trigger a loss of the mitochondrial transmembrane potential, resulting in the release of cytochrome *c* and thereby initiating the cascade of caspases which is central to the apoptotic process (Voehringer, 1999). Oxysterols are the products of cholesterol oxidation and are commonly found in highly processed foods of animal origin. Certain oxysterols including 7 β -hydroxycholesterol (7 β -OH) have been shown to induce apoptosis *in vitro*. The objective of the present study was to monitor the alteration in cellular GSH content of the U937, a human monocytic blood cell line over 48 h in response to treatment with the oxysterols 7 β -OH, 25-hydroxycholesterol (25-OH) and cholesterol 5 β ,6 β -epoxide (β -epox). Cell viability and apoptosis were also assessed at each of the time points.

U937 cells were adjusted to a density of 2×10^5 cells/ml in RPMI 1640 medium supplemented with 25 ml/l fetal calf serum. Cells were treated with 30 μ M oxysterol and incubated at 37°, air:CO₂ (95:5). Control cells were treated with an equal volume of ethanol. The concentration of GSH was determined at 3, 6, 12, 24 and 48 h using the method of Hissin and Hilf (1976) and expressed relative to the protein content, which was measured using the BCA method (Smith *et al.*, 1985). Viability was assessed by the fluorescein diacetate-ethidium bromide assay and apoptotic nuclei were quantified microscopically following staining with Hoechst 33342.

	Viable cells (%)				Apoptotic cells (%)				Glutathione (nmol GSH/mg protein)			
	Control		β -Epox		7 β -OH		25-OH		Control		7 β -OH	
	7 β -OH	25-OH	β -Epox	Control	7 β -OH	25-OH	β -Epox	Control	7 β -OH	25-OH	β -Epox	Control
3 h	97.0	84.9	92.5	96.5	2.8	4.1	4.8	5.1	34.1	30.0	34.7	34.2
6 h	96.3	84.0	96.5	96.3	2.8	6.1	3.8	4.1	47.7	36.1	48.3	33.5
12 h	93.1	78.0	89.5	85.2	6.3	7.8	4.9	7.7	43.2	24.7	48.8	42.5
24 h	88.8	69.1	89.7	78.0	4.7	18.4	5.5	16.1	48.1	27.0	62.6	67.2
48 h	95.5	8.0	84.9	26.8	6.2	38.3	6.2	32.5	35.2	0.0	66.6	0.0

There appeared to be a slight decrease in the GSH content of 7 β -OH treated cells as early as the 3 h time point. GSH continued to be depleted until the 12 h time point, where it was less than 60% of the control value. Apoptosis was not apparent until the 24 h time point although there was a decrease in viability at the 12 h time point. 25-OH induced a slight decrease in viability following 48 h of incubation but there was no evidence of apoptosis. GSH content was found to increase in cells treated with 25-OH which may indicate an antioxidant effect. β -Epox was found to be less cytotoxic than 7 β -OH but was also shown to induce apoptosis at both the 24 and 48 h time points. GSH was not depleted at the 12 h time point and its content increased at 24 h. GSH content was depleted at the 48 h time point for both 7 β -OH and β -epox-treated cells as there was a large decrease in viability. GSH depletion would appear to be an early event in 7 β -OH-induced apoptosis, with the depletion beginning as early as 3 h after exposure while apoptosis was not evident until the 24 h time point. As glutathione was not depleted in the early stages of β -epox-induced apoptosis, it is possible that 7 β -OH and β -epox may induce apoptosis by different mechanisms in the U937 cell line.

Hissin PJ & Hilf R (1976) *Analytical Biochemistry* **74**, 214-226.
Smith PK, Krohn RI, Hermanson GT, Mallia AK, Garner FH, Provenzano MD, Fujimoto FK, Goeke NM, Olsen BJ & Klensk, DC (1985) *Analytical Chemistry* **150**, 76-85.
Voehringer DE (1999) *Free Radical Biology and Medicine* **27**, 945-950.

Effects of an algal extract containing astaxanthin on UVA-irradiated human skin fibroblasts in culture. By N.L. LYONS and N.M. O'BRIEN, *Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

UV radiation from sunlight is the most potent environmental risk factor in skin cancer pathogenesis (England *et al.* 1997). It is now believed that antioxidants may play a crucial role in ameliorating or indeed preventing photobiologic damage (phototoxicity, photoageing and cancers) *in vivo* (Greenberg *et al.* 1990). In the present study, the ability of an algal extract to protect against UVA-induced DNA alterations was examined in cultured human skin fibroblast (IBR-3) cells. The protective effects of the proprietary algal extract, which contained a high level of the carotenoid astaxanthin (algal AST), were compared with synthetic astaxanthin (AST).

DNA damage was assessed using the single cell gel electrophoresis or comet assay. In IBR-3 cells, synthetic astaxanthin prevented UVA-induced DNA damage at all concentrations (10 µM, 100 nM, 10 nM) tested. The algal extract conferred protection against UVA-induced DNA damage when the equivalent of 10 µM astaxanthin was added to IBR-3 cells; however, the lower concentrations of 10 nM and 100 nM offered no significant protective effect. There was a 4.6-fold increase in AST content of the cells exposed to the synthetic compound and a 2.5-fold increase in cells exposed to the algal extract (data not shown).

Treatment	Olive Tail moment		Olive Tail moment		SOD activity		GSH content	
	(arbitrary units)		(arbitrary units)		(units/mg) protein		(nmol/mg) protein	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Untreated cells	4.4	0.1	5.6	1.1	6.2	2.2	37.4	1.9
Solvent control	3.9	0.1	5.9	0.5	4.3	3.5	43.3	7.1
UVA Treated	9.8**	0.8	10.1**	1.4	18.4**	4.2	21.1*	4.9
UVA + 10 µM AST	3.8	0.4	5.4	0.2	2.8	0.8	38.3	0.3
UVA + 100 nM AST	5.5	1.8	7.3*	0.4	ND	ND	ND	ND
UVA + 10 nM AST	5.4	0.1	9.2**	1.5	ND	ND	ND	ND

Data are means ± SE of n=3 independent experiments. **P<0.01, *P<0.05 – significantly different from control cells.

The cellular antioxidant status of IBR-3 cells was also examined following irradiation for 2 h with UVA. UVA-irradiation resulted in a significant induction of cellular superoxide dismutase (SOD) activity, coupled with a marked decrease in cellular glutathione (GSH) content. However pre-incubation (18 h) with 10 µM of either the synthetic astaxanthin or the algal extract prevented UVA-induced alterations in SOD activity and GSH content. This work suggests a role for the algal extract as a potentially beneficial antioxidant in human skin.

England DR, Armstrong BK, Kriker A & Fleming C (1997) *Cancer Causes and Control* **8**, 271–283.
Greenberg ER, Baron JA, Stukel TA, *et al.* (1990) *New England Journal of Medicine* **323**, 789–795.

Development of an *in vitro* model to estimate the bioavailability of carotenoids. By S.M. O'SULLIVAN and N.M. O'BRIEN, *Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

The carotenoid content of a supplement or foodstuff does not necessarily represent the amount available to the consumer. The bioavailability of carotenoids can be inhibited or promoted by interactions between food components or the food matrix, or by food processing and meal preparation methods. Traditional methods for estimating bioavailability, although useful, have disadvantages associated with them including inaccuracy and expense. The objective of this study was to develop an *in vitro*, cost-effective model for the determination of the bioavailability of carotenoids.

In the present study, carotenoid-containing powdered supplements were subjected to an *in vitro* digestion procedure. Following the procedure of Garrett *et al.* (1999), the supplements were digested by the addition of a number of enzymes analogous to gastric and intestinal enzymes, and incubated at 37° for specified times. The digestate obtained was ultracentrifuged and the supernatant was passed through a filter to remove microcrystalline non-micellized carotenoids that were not pelleted during ultracentrifugation. This process provided a supernatant containing micellized carotenoids. The *in vitro* model employed consisted of differentiated human colonic adenocarcinoma Caco-2 cells, which were seeded on the top chamber of a transwell plate at a density of 4×10^4 cells/cm² and grown in Dulbecco's modified Eagle's medium supplemented with 10% (v/v) fetal calf serum until they had differentiated. The differentiated Caco-2 cells resemble enterocytes of the small intestine both in structure and in function. The transwell plate allows passage of compounds from the top chamber to the bottom chamber, analogous to passage from the lumen through the enterocytes and into the blood or lymphatic system. Differentiated Caco-2 cells were incubated for 6 h with test media (a sample of the micellized carotenoids combined with normal growth media). Following the 6 h incubation period, cells were washed thoroughly and analysed for carotenoid uptake. Cellular carotenoid content was analysed by reverse phase HPLC.

Carotenoids	Digested Supplement		Micelles		Cells	
	µg/ml		µg/ml		ng/mg Protein	
	Mean	SE	Mean	SE	Mean	SE
Lutein	305.7	18.2	10.1	5.8	34.8	7.0
Zeaxanthin	111.7	39.2	1.6	0.4	7.0	0.3
Lycopene	175.0	14.4	1.0	0.9	0.9	0.5
α-Carotene	160.6	22.6	2.9	1.1	6.1	3.3
β-Carotene	288.7	64.9	4.4	2.5	15.5	9.8

All five carotenoids were present in the digestate at concentrations that were not significantly different to the initial concentrations (data not shown) present in the supplement. The efficiency of transfer of the compounds to the micelles differed; the highest percentage transferred was 3% for lutein and the lowest was 0.5% for lycopene. With respect to cellular uptake, it appears that there was a greater uptake of the more polar carotenoids compared with the more apolar carotenoids. Future experiments will determine whether other dietary components, e.g. the addition of a fat source, may increase the transfer of carotenoids to micelles and hence their bioavailability and uptake into the cells.

Garrett DA, Failla ML & Surama RJ (1999) *Journal of Agricultural and Food Chemistry* **47**, 4301–4309.

Nutritional intake, knowledge and supplement use of competitive Irish cyclists. By E. O'SULLIVAN^{1,2}, P. DORAN³ and E.P. MCNAMARA², ¹University of Dublin, Trinity College, Dublin 2, Republic of Ireland, ²Department of Biological Sciences, Kevin Street, Dublin 8, Republic of Ireland and ³Cycling Ireland, 619 North Circular Road, Dublin 1, Republic of Ireland

Competitive cycling is an energetically demanding sport. Cyclists in training have very high energy and carbohydrate intakes and adequate intakes of most other nutrients, while energy and carbohydrate intakes increase when racing (Burke, 2001). Male athletes generally score poorly in nutrition knowledge surveys (Weitzel & Myers, 1995). Use of supplements is more prevalent in athletes (46%) than in the general population (35–40%), while their use is more prevalent still among elite athletes (59%) (Maughan, 2002).

Twenty-two competitive Irish male cyclists were recruited. Nutritional intake while training was assessed using a food diary which was kept over three consecutive days, including one weekend day. Household measures were used to quantify amounts of food eaten. Nutritional intake on a 150 km race day was investigated using 24-h dietary recall. Nutrition knowledge and supplement use were assessed using a self-administered questionnaire. Mean age of the sample was 26.4 years, mean BMI was 22.1 kg/m² and mean weight was 70.2 kg. Mean fluid intake was 2.7 litres per day (SD 1.1 litres) while training and 4.8 litres (SD 1.2 litres) on the race day. Nutrient intakes excluding supplements are shown in the table.

	Training		Race day		P value
	Mean	SD	Mean	SD	
Energy (MJ)	13.8	4.2	17.4	4.3	0.000
Carbohydrate (g)	478	131	766	194	0.000
Carbohydrate (% E)	55	8	69	7	0.000
Fat (g)	107	62	84	34	0.030
Fat (% E)	29	8	18	5	0.000
Protein (g)	118	35	114	45	0.549
Protein (% E)	15	3	12	3	0.000
Calcium (mg)	1358	602	1083	481	0.021
Iron (mg)	19.5	6.9	24	9	0.015
Vitamin C (mg)	141	81	196	240	0.233
Folic acid (µg)	372	191	659	551	0.007
Zinc (mg)	14	5	13	6	0.985
Vitamin E (mg)	10	7	10	6	0.489

Mean score in the knowledge questionnaire was 78.5% (SD 6.9%). Of the participants, 54% (*n* 12) incorrectly thought that “high protein diet or protein supplements can help build bigger and stronger muscles”. Awareness of fluid issues was high, with an average score of 11.1 out of 14. Supplement use was very prevalent, with 95% taking at least one supplement and 77% currently taking a multivitamin supplement; 41% were currently taking iron supplements and 36% were taking a vitamin C supplement. Other supplements being taken included minerals (28%), protein/amino acid (23%), cod liver oil (18%), calcium (14%), caffeine (14%), vitamin E (9%), zinc (9%), ginseng (9%), co-enzyme Q10 (9%) and sodium phosphate (9%). Of the subjects, 54% (*n* 12) stated that they were unhappy with their current weight. Of those who wanted to lose weight, average desired weight loss was 3.7 kg.

Energy and micronutrient intakes were generally adequate and met recommendations in both the training and racing diets, but were consistently lower than intakes recommended in the literature. Fluid intakes need to be increased whilst training and during events. This study indicates that cyclists have a good level of nutrition knowledge. It also established that the use of supplements is extremely prevalent among these athletes and this could lead to expensive and even dangerous practices.

Burke LM (2001) *Sports Medicine* **31**, 521–532.
Maughan RJ (2002) *Proceedings of the Nutrition Society* **61**, 87–96.
Weitzel NL & Myers EF (1995) *Journal of the American Dietetic Association* **A-99**.

The effect of various types of nutritional education on the nutritional knowledge of senior inter-county Gaelic Athletic Association hurlers. By C. BREEN^{1,2}, E. MCNAMARA^{1,2} and H.M. ROCHE¹, ¹Department of Clinical Medicine, Trinity Health Sciences Centre, St. James's Hospital, Dublin 8, Republic of Ireland and ²Department of Biological Sciences, Kevin Street, Dublin 8, Republic of Ireland

Aside from heredity and training, no single factor plays a greater role in optimizing performance than diet (Hawley *et al.* 1995). Hence, athletes want and need reliable, accurate information (Henry, 2001). The nutritional education of some athletes is neglected completely (Lewis *et al.* 2001). Also, many athletes get their information from invalid sources (Chieppa, 2000). Nutritional education is the key to combating misinformation (Potter *et al.* 1991). However, the effectiveness of different methods of nutritional education for athletes is not a topic which has been covered extensively in the literature.

The sports nutrition knowledge of forty-one male subjects from five different senior inter-county hurling teams was assessed using a self-administered sports nutrition knowledge questionnaire. A percentage score of correctly answered questions was calculated. The effects of the professional status of the advisor and the type of programme undertaken (whether individualized consultations or group-based advice) on the nutrition knowledge score of subjects was then assessed. Subjects' attitude towards nutritional education was also examined within the questionnaire.

Team	Professional status of advisor	Type of programme undertaken by advisor	Mean nutrition knowledge score (%)
Team A (<i>n</i> 7)	Qualified clinical nutritionist	Individualized consultations	73.8
Team B (<i>n</i> 10)	Qualified nutritionist	Once-off group lecture	63.9
Team C (<i>n</i> 8)	Physical Education teacher	Individualized consultations	68.1
Team D (<i>n</i> 9)	Physical Education teacher	Once-off advice in the form of a typed handout	60.5
Team E (<i>n</i> 7)	No advisor	No programme	50.8

Mean nutrition knowledge score for the sample was 63.4% (SD 12%). The nutrition knowledge score was significantly different between teams (*P* = 0.002); team E was significantly lower than Teams A and C. There was a high level of knowledge across the sample in relation to peri-event fluid recommendations and 100% of subjects correctly identified common dietary sources of carbohydrate. There was a high level of misconception in relation to protein requirements for athletes, 82.9% of the sample believed that athletes required large amounts of dietary protein to increase muscle mass. Team E had a significantly lower knowledge score than Team A in relation to post-event fluid intake (*P* = 0.009), pre-event protein recommendations (*P* = 0.012) and high-energy drink suitability (*P* = 0.01). The study cohort had a very positive attitude towards nutritional education, 85.4% of subjects considered that the nutritional education of inter-county hurlers was important.

While the overall nutritional knowledge of participants was good, the knowledge of the uneducated participants was poor. It is therefore essential that all senior inter-county GAA hurlers be given access to nutritional education. A nutritional policy ensuring this should be produced and implemented by the Gaelic Athletic Association.

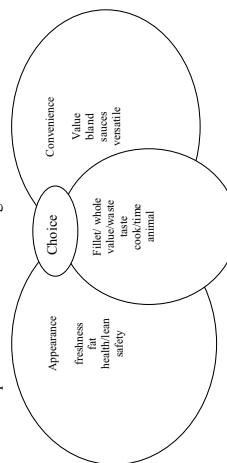
Chieppa J (2000) The effectiveness of nutrition education on nutrition knowledge of female college athletes. MSc Thesis, West Virginia University, West Virginia, USA.
Hawley JA, Dennis SC, Lindsay FH & Noakes TD (1995) *Journal of Sports Science* **13**, S75–S87.
Henry P (2001) In *Nutritional Applications in Exercise and Sport*, pp. 251–260 [J Wolinsky and JA Driskell, editors]. London: CRC Press.
Lewis RD, Masson J & Crawford K (2001) In *Nutritional Applications in Exercise and Sport*, pp. 261–275 [J Wolinsky and JA Driskell, editors]. London: CRC Press.
Potter GS & Bennett-Wood O (1991) *Journal of Nutrition Education* **21**, 288–290.

Consumer choice of chicken. By O.B. KENNEDY, B.J. STEWART-KNOX, P.C. MITCHELL and D.I. THURNHAM, *Northern Ireland Centre for Diet and Health, School of Biomedical Sciences, University of Ulster, Cromore Road, Coleraine, BT52 1SA*

Culturally, meat is associated with wealth and consumption is seen as a reflection of economic conditions (Nestle, 1999). Changing consumption patterns of meat also reflect attitudinal shifts in regard to health, nutrition, food safety and convenience. Red meat consumption has declined in response to the BSE debacle and subsequent restrictions upon beef export, as well as the foot and mouth crisis and general health concerns as a result of putative links to cancer. Poultry consumption has consequently increased and now accounts for 40% of all meat eaten in the UK (MAFF, 2000). It has therefore become increasingly important to determine factors determining choice of chicken meat.

Studies into consumer perceptions of meat have tended to use quantitative methodologies that have provided a wealth of statistically malleable information but little in-depth insight into consumer perceptions of meat. The aim of the present study was to gain an insight into the factors which consumers deem important in the selection of chicken meat, using qualitative methodology.

Six focus group discussions (*n* 37, 29 females, 8 males, age-range 18–55+) were undertaken to explore this topic area in depth. A topic list devised from previous literature was used to guide the discussions and covered areas such as shopping habits and consumption patterns of meat. The dialogue was tape-recorded, transcribed verbatim and thematically content analysed. Themes arising implied that 'appearance' and 'convenience' were the most important determinants of choice of chicken meat and these themes were interwoven with sub-themes such as versatility, healthiness and value. A descriptive model shown below has been developed to illustrate the hierarchy and interrelationship between factors affecting chicken meat choice.



MAFF (2000) *Poultry and Poultry Meat Statistics Notice*. Nottingham: Government Statistical Service.
Nestle M (1999) Proceedings of the Nutrition Society **58**, 211–218.

Risk perception in expert and non-expert groups. By A. MULLEN¹, J. LAMBE² and M.J. GIBNEY¹, ¹*Department of Clinical Medicine, Trinity Centre for Health Sciences, St. James' Hospital, Dublin 8 Republic of Ireland and* ²*Institute of European Food Studies, Biotechnology Institute, Trinity College, Dublin 2, Republic of Ireland*

Risk analysis is a process of three elements: risk assessment, risk management and risk communication. Risk assessment is the characterization of potential effects of exposure to hazards through scientific measurements, analytical techniques and interpretative models. Risk management is the evaluation of alternative risk control actions, selection and implementation of the most appropriate among them. Risk communication is the process of exchange of information, concern and opinion among individuals, groups and institutions (Kindred, 1996). The role of the technical expert is clear and uncontested in risk assessment. Risk communication efforts may, however, require more than presentation of objective views. The non-expert audience may not appreciate the qualities of risk recognized by experts. It is, therefore, important to recognize and acknowledge differences in expert and non-expert judgements of risk and to refer to audience positions for effective risk communication.

The aim of this study was to examine expert and non-expert perceptions of risk. It was based around an expert and a non-expert questionnaire and fifteen hazards, ten of which were food-related, were referred to. Forty members of the scientific committees of the Food Safety Authority of Ireland participated as expert subjects in the study and were matched by forty non-expert subjects from the public.

Non-experts were found to have higher perceptions of risk to personal well-being and to Irish society for all hazards where risk rankings differed significantly between the groups. Experts ranked as more controlled regarding all hazards where significant differences existed between the groups. Perceived control correlated negatively and significantly with perception of risk to Irish society in both groups. With perception of good control, risk perception was less. With perception of poor control, risk perception was greater. The possibility of a hazard having unknown health effects has been suggested as an influence on risk perception but there were no significant correlations between the possibility of unknown health effects and rankings of risk in this study. Significant differences in perceived need for risk mitigation between experts and non-experts for a number of hazards were found, but both groups ranked alcohol and smoking as the hazards with greatest need for risk reduction.

Experts were asked to rank how they felt non-experts perceived hazards to Irish society and these were compared to the actual non-expert rankings of risk. Experts ranked non-expert judgements of alcohol, obesity, smoking and antibiotics in food significantly lower than non-experts ranked the hazards. Non-experts perceived these hazards as having greater risk than the experts think they do. Experts ranked non-expert judgements of BSE, genetically modified foods and blood transfusion significantly greater than non-experts ranked the hazards. Non-experts perceived these hazards as having less risk than the experts think they do. The study found that experts perceived media reporting and intuition as the two greatest influences on non-expert perception of risk, while non-experts chose personal experience and common sense as the two greatest influences on how they judge a risky situation. Neither group chose expert statements as one of the greatest influences on non-expert perception of risk.

It was found that expert perceptions of the source and degree of their market's risk perceptions were somewhat removed from non-expert indications. Getting to know the non-expert market, their perceptions and what influences them may improve risk communication.

Kindred TP (1996) *Journal of Food Protection* **59**, Suppl., 24–30.

Effects of oral physiology on the release of aroma from model food systems using two model mouth simulators. By M.D. GEARY¹, S.M. VAN RUTH¹, E.H. LAVIN², C.M. DELAHUNTY¹ and T.E. ACREE², ¹Department of Food Science, Food Technology and Nutrition, University College Cork, Cork, Republic of Ireland and ²New York State Agricultural Experiment Station, Department of Food Science and Technology, Cornell University, Geneva, New York 14456, USA

The aroma released from a food or beverage during consumption greatly contributes to a person's evaluation of the palatability and acceptance of a food or beverage. The physical and chemical characteristics of the main food groups, proteins, lipids, and carbohydrates primarily determine the rate and extent of the release of aroma from the food matrix. During eating, the food or beverage is manipulated in the mouth into a form suitable for swallowing. This involves breakdown of the food into smaller particles, moistening and mixing of the food with saliva, and changes in the food's viscosity. Consequently, a person's mastication rate and saliva flow rate play important roles in the processing of food and beverages and in the subsequent release of aroma during oral digestion.

The objective of this study was to determine whether observed differences in saliva flow rates (Bardow *et al.* 2001) and mastication rates (Brown, 1994) between people result in significant differences in aroma release during consumption.

The influence of four saliva flow rates and five mastication rates on the release of twenty aroma compounds (0.001% v/v) was examined using three model food systems. Sunflower oil-in-water emulsions, varying in lipid phase fraction (emulsions A and B) and containing added starch (emulsion C), and two mouth simulators were evaluated. Air/liquid partition coefficients of the compounds when exposed to varying emulsion-to-saliva ratios were determined using static headspace gas chromatography. Dynamic time-averaged release of compounds for two of the emulsions (A and B) was determined using van Ruth's model mouth system (van Ruth & Roozen, 2000), while the retronasal aroma simulator (RAS; Roberts & Acree, 1995) was used for the third emulsion (C). For both mouth simulators, varying emulsion-to-saliva ratios were used to simulate four different saliva flow rates. To replicate differences in chewing and mixing of the samples, a plunger in the case of van Ruth's model mouth system and an impeller in the case of the RAS were connected to a voltage-controller and variable-speed motor to allow the precise control of the speeds.

Increasing the rate of mastication resulted in significant ($P < 0.05$), but proportional, increases in release for all compounds. For both mouth simulators, a significant ($P < 0.05$) effect of saliva dilution on the release of compounds was found to be compound-specific.

The importance of mastication rates and saliva flow rates on the dynamic process by which foods are broken down and aroma is released was found to differ between both the samples analysed and between the oral physiological parameters used.

Bardow A, Nyvad B & Naumofte B (2001) *Archives of Oral Biology* **46**, 413–423.
Brown WE (1994) *Journal of Texture Studies* **25**, 1–16.
Roberts DD & Acree TE (1995) *Journal of Agricultural and Food Chemistry* **43**, 2179–2186.
van Ruth SM & Roozen JP (2000) *Food Chemistry* **71**, 339–345.

Some like it hot: influence of chemical irritation on flavour and texture perception. By C.G. FORDE and C.M. DELAHUNTY, Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland

Chemical irritation perception, such as the *spiciness* of capsaicin, is an important determinant of food preferences. However, food preferences are based on a complex integrative process whereby cross-modal sensory information is combined centrally to form the perceptual response. Chemical irritation has been shown to interact with tastes and aromas (Lawless & Stevens, 1984), and is believed to influence the perception of texture (Forde *et al.* 2002; Forde & Delahunty, 2002), suggesting that perception in one modality may influence perception in another.

In the first experiment, the influence of capsaicin irritation on particle size discrimination, oral stereognosis (identification of shapes or forms in the mouth) and thickness perception, three distinct texture acuity measures, was investigated. A second experiment investigated the impact of chemical irritation on the perception of taste, smell and texture stimuli in combination. Twenty non-expert assessors, (N=10 males, N=10 females) between the ages of 20-30 years carried out all sensory analyses, and the chemical irritant was administered as a pre-rinse during each assessment.

Results showed that particle size discrimination ability was progressively impaired with increasing levels of capsaicin irritation; however, oral stereognosis ability progressively improved. Thickness discrimination ability was investigated by ability to perceive the differences in seven Carboxy methyl cellulose (CMC) solutions. Thickness perception showed a gradual improvement with increasing levels of capsaicin irritation; however, the slope of the psychophysical function decreased progressively. There was change in the perceived difference threshold of the CMC solutions, increasing progressively with higher levels of capsaicin irritation (17.67, 16.83, 22.5 and 30.0%). The second study demonstrated significant interactions between chemical irritation and taste, aroma and texture perception, which was seen as a quantitative change in perceived intensity, although taste was influenced directly to the greatest extent, in accordance with previous research. Chemical irritation can both inhibit and enhance perception in other senses, depending on the concentration, the interacting stimuli and the temporal characteristics of the sensation. Results showed that sensory interactions occur between the chemical irritation and flavour and texture perception that merit further investigation, to determine their influence on preferences in real food systems.

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Lawless HT & Stevens DA (1984) *Physiology and Behavior* **32**, 995–998.
Forde CG, Cantua B, Delahunty CM & Elsner RJE (2002) *Journal of Nutrition, Health and Aging* **6**, 130–133.
Forde CG & Delahunty CM (2002) *Food Quality and Preference* (In Press).

Energy and macronutrient intakes reported by adolescents in Northern Ireland: comparison of 1990 and 2000 data. By O.A. WARD¹, P.J. ROBSON¹, G.W. CRAN² and C.A.G. BOREHAM¹. ¹The Northern Ireland Centre for Diet and Health (NICHE), University of Ulster, Coleraine BT52 1SA, ²Department of Epidemiology and Public Health, The Queen's University of Belfast, BT12 6BJ and ³School of Applied Medical Sciences and Sport Studies, University of Ulster, Jordanstown, BT37 0QB

The nutritional quality of the adolescent diet is an ongoing concern (Smithers *et al.* 2000). While data from the USA suggest that adolescent food choices have changed undesirably over time (Cavadini *et al.* 2000), there is a dearth of recent information on time-related changes in dietary intakes in the UK and Ireland. The purpose of this study was to describe and evaluate secular trends in the energy and macronutrient intakes reported by adolescents in Northern Ireland in 1990 and 2000, and to identify the major food sources of macronutrients in the 2000 cohort.

Representative samples of adolescents aged 12 and 15 years were randomly selected from post-primary schools, as part of the Young Hearts project, in 1990 (YH1, *n* 1015) and again in 2000 (YH2000, *n* 1017). In both cohorts, dietary intakes were assessed using the diet history method, and people with EIBMR <1.4 or >2.5 were excluded. The remaining participants in YH1 (*n* 815) and YH2000 (*n* 1549) were then separated into four age-sex groups (12-year-old boys, *n* 602; 12-year-old girls, *n* 610; 15-year-old boys, *n* 577; 15-year-old girls, *n* 575) in order to compare 1990 data with 2000 data.

Daily median values	All subjects		12-y-o boys		12-y-o girls		15-y-o boys		15-y-o girls	
	YH1	YH2000	YH1	YH2000	YH1	YH2000	YH1	YH2000	YH1	YH2000
Energy (MJ/d)	10.3	10.6**	10.5	10.8*	9.2	9.6**	12.8	12.5**	9.5	9.8
Energy from protein (%)	11.0	11.4**	11.2	11.2	10.8	11.3*	11.1	11.4	10.8	11.7**
Energy from CHO (%)	52.3	56.6***	52.5	57.5***	52.6	56.7***	52.1	56.0***	51.7	55.4***
Energy from sugar (%)	21.4	24.8***	21.5	25.3***	22.3	24.9***	21.0	24.0***	20.9	24.6***
Energy from fat (%)	38.9	34.9***	39.0	34.4***	38.5	35.2***	38.6	34.4***	39.2	35.5***
Energy from SFA (%)	15.2	13.3***	15.8	13.1***	15.1	13.4***	15.3	13.1***	15.1	13.7***
Energy from MUFA (%)	12.5	11.1***	12.6	11.0***	12.3	11.2***	12.5	11.0***	12.6	11.3***
Energy from PUFA (%)	5.7	4.7***	5.1	4.8***	5.9	4.6***	5.4	4.7***	6.3	4.8***
Fibre (g/d)	20.4	21.1**	19.1	21.4***	21.8	18.9***	20.4	25.0**	20.4	20.1

Median values significantly different from YH1 using the Kolmogorov-Smirnov test, **P* < 0.05, ***P* < 0.01, ****P* < 0.001. CHO carbohydrates, SFA saturated fatty acids, MUFA monounsaturated fatty acids, PUFA polyunsaturated fatty acids.

Compared with adolescent subjects assessed in 1990, overall median energy intakes assessed in 2000 had increased by 3% (*P* < 0.001). A significant increase in energy intake was observed across all the age-sex groups, except 15-year-old boys, where it fell. The macronutrient composition of the reported diets also changed over this period. In all age-sex groups, there was a significant decrease (*P* < 0.001) in the percentage of energy derived from fat, SFA, MUFA and PUFA and a significant increase (*P* < 0.001) in the overall percentage of energy derived from CHO and total sugars. A marked increase (*P* < 0.001) was also noted in the percentage of 15-year-olds consuming alcohol (YH1, 25% v. YH2000, 38%). Overall, the adolescents assessed in 2000 reported diets closer to the recommended intakes for fat than the equivalent group of adolescents in 1990 (Department of Health, 1991). Nevertheless, the vegetable and fruit intake in the YH2000 cohort remained low (three portions/d) and the sugar intake continued to remain high. The primary sources of sugar in the YH2000 were confectionery and carbonated drinks, while the primary sources of fat were chips and crisps and meat and meat products.

The results indicate that, despite some improvements, further health promotion efforts are needed to increase the consumption of complex carbohydrates and fruit and vegetables.

The work was supported by DHSSPS (NI).

Cavadini C, Siega-Riz & Popkin BM (2000) *Archives of Diseases in Childhood* **83**, 18–24.

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.

Smithers G, Gregory JR, Bates CJ, Prentice A, Jackson LY & Wenlock R (2000) *Nutrition Bulletin*, **25**, 105–111.

Birth weight, breast-feeding and body fatness in Northern Irish adolescents: the Young Hearts project. By S.M. McELHONE¹, J. TWISK², P.J. ROBSON³, L. MURRAY⁴ and C.A.G. BOREHAM¹. ¹Young Hearts Project, University of Ulster, Jordanstown, BT37 0QB, ²University of Vrije, Amsterdam, The Netherlands, ³Northern Ireland Centre for Diet and Health (NICHE), University of Ulster, Coleraine, BT52 1SA and ⁴Department of Epidemiology and Public Health, The Queen's University of Belfast, BT12 6BJ

In humans, low birth weight has been associated with an increased risk for the development of obesity in later life (Barker *et al.* 1997). While it has been suggested that breast-feeding in infancy may be protective against the development of overweight and obesity in childhood and adolescence (Gillman *et al.* 2001), others have found no such association (Wadsworth *et al.* 2002). The aim of the present study was to examine the extent of the relationships between birth weight, breast-feeding practices and body fatness measured in a large cross-sectional study of adolescents.

A random sample of 2017 adolescents aged 12 years and 15 years was recruited from post-primary schools in Northern Ireland (12-year-old boys, *n* 515; 12-year-old girls, *n* 532; 15-year-old boys, *n* 487; 15-year-old girls, *n* 483). Height, weight, skinfold thicknesses (biceps, triceps, subscapular, suprailiac), and waist and hip circumferences were measured in all subjects. Pubertal status was assessed, and information concerning each subject's birth weight and duration of breast-feeding was obtained from parent(s) by questionnaire. Information on birth weight was obtained for 89% of the study population, and of these, almost all parents (91.5%) provided information on their breast-feeding practice. Of the subjects who had been breast-fed (29.2%), the majority had been breast-fed for up to 3 months (59.8%).

The extent of the relationships was assessed using multiple linear regression analyses, and results are presented using unstandardized regression coefficients (β) and *P* values. Several relationships between birth weight and adolescent body fatness were found in 12-year-old boys. In this group, higher birth weight was significantly associated with being heavier (β 2.87, *P* < 0.001). In other words, a 1 kg increase in birth weight was associated with a 2.87 kg increase in body weight at age 12 years. Higher birth weight in 12-year-old boys was also associated with having a larger body mass index (β 0.69, *P* 0.02), but also with lower central body fat, indicated by lower subscapular/triceps ratios (β -0.01, *P* < 0.001). Birth weight was negatively associated with subscapular/triceps ratio in 15-year-old males and females (β -0.07 and -0.04, respectively, *P* < 0.05), and positively associated with height (mm) in all four age-sex groups (β 21.36, 25.98, 32.19 and 25.46, respectively, *P* < 0.001). Only one significant association between breast-feeding and body fatness was found; longer duration of breast-feeding was associated with lower waist/hip ratios in 15-year-old boys (β -0.03, *P* 0.01). No statistically significant associations were found between breast-feeding and body fatness measure in 12-year-old boys, 12-year-old girls or 15-year-old girls. Stratified analyses were then performed for two birth weight groups (subjects in the lowest quartile for birth weight v. subjects in the remaining three birth weight quartiles). Significant associations were apparent only in the 12-year-old boys. In the lowest birth weight quartile, breast-feeding was positively associated with body fat measurements, in particular central body fatness, as indicated by an increased suprailiac skinfold measurement (β 3.8, *P* 0.04). In the 'normal' birth weight group, an inverse association was found between breast-feeding and (central) body fatness indicated by lower waist/hip ratios (β -0.01, *P* 0.05), and lower subscapular (β -1.46, *P* 0.04) and suprailiac skinfolds (β -2.76, *P* 0.01). In summary, birth weight appeared to be associated with body fatness measurements in 12-year-old boys only. This may be due to the fact that most of the 12-year-old boys had not yet reached puberty, while the other three age-sex groups were either approaching maturity, or were mature. Perhaps puberty masks the effect of birth weight on adolescent body fatness. The main findings suggest that breast-feeding practice does not have a major impact on adolescent body fatness in all age-sex groups, and that birth weight may be an important factor in determining body fatness in 12-year-old boys.

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Barker M, Robinson S, Osmond C & Barker DJP (1997) *Archives of Disease in Childhood* **77**, 381–383.

Gillman MW, Rifas-Shiman SL, Canargo CA, Berkeley CS, Frazier AL, Rockett HRH, Field AE & Colditz GA (2001) *Journal of the American Medical Association* **285**, 2461–2467.

Wadsworth M, Marshall S, Hardy R & Paul A (2002) *British Medical Journal* **319**, 1576–1577.

Energy and nutrient intakes among healthy overweight volunteers, maintained on low-sucrose (5% energy) and sucrose-containing (10% energy), weight-reducing diets. By ^{1,2} MARY FINN and ²MARY MOLONEY ¹University of Dublin, Trinity College Dublin, Ireland and ²Dublin Institute of Technology, Kevin Street, Dublin 8, Ireland.

Traditionally weight-reducing diet sheets recommend low-fat, low-sugar regimens. However restriction of sugar leads to a counterproductive rise in fat intake (Drummond & Kirk, 1999), a phenomenon known as the sugar: fat seesaw. Studies have shown that satisfactory weight loss can be achieved whether or not sucrose is included in the dietary regimen (West & de Looy, 2001; McCreery, 1991). West & de Looy (2001) also showed that the inclusion of moderate levels of sucrose (up to 10% of energy) did not compromise micronutrient intakes despite a reduction of energy intake to a level where weight was lost.

This present study compares weight change, energy, macronutrient and micronutrient intakes of individuals maintained on a low-sucrose (5% energy) and sucrose-containing (10% energy) weight-reducing diet.

Sixty-one subjects (thirty-five males and twenty-six females), who were greater than 6.4 kg (one stone) overweight, completed the four-week programme. Two different weight-reducing diets were devised, a low-sucrose diet (LSD) providing 5% sucrose energy and a sucrose-containing diet (SCD) providing 10% sucrose energy. Prescribed diets had a deficit of approximately 2.5 MJ (600 kcal) of initial energy intake. This was a cross over study, which involved subjects being prescribed a LSD diet for two weeks and a SCD diet for two weeks.

	Males				Females			
	Baseline	LSD	SCD	p†	Baseline	LSD	SCD	p†
Weight change (kg)	89.5	1.3	NS	1.5	75.5	0.7	NS	1
Fat (% En)	34.7	25.8	<0.001	23.4	39.3	25.4	<0.001	25.5
Sucrose (% En)	5.2	6.1	NS	9.1	<0.001	2.2	4.5	<0.002
Carbohydrate (% En)	48	55.7	<0.001	59.5	<0.001	44	54.7	<0.001
Protein (% En)	16.1	20.9	<0.001	20.3	<0.001	15.3	21.1	<0.001

*Significant difference between baseline and LSD

†Significant difference between baseline and SCD

Body weight decreased significantly during the four week study period for both males and females. Total weight loss was 2.8 kg for males and 1.7 kg for females. There was also a significant decrease in BMI of 0.9 kg/m² for males and 0.6 kg/m².

Micronutrient intakes were similar on the LSD and SCD despite a significantly higher intake of sucrose on the SCD compared to the LSD. A large percentage of the sample of males and females had calcium (31% of males, 42% of females), iron (14% of males, 73% of females) and folate (71% of males, 92% of females) intakes below the Recommended Daily Allowance (RDA, FSAI 1999) at baseline. Prescribed diets were adequate in all of these nutrients. However intakes remained below the RDA throughout the study period, suggesting unsatisfactory compliance to the weight reducing diets.

Thus it appears that the inclusion of moderate levels of sucrose (up to 10% of energy) to weight-reducing diets helped to achieve the recommended low fat high carbohydrate diet, resulted in a significant weight loss, and did not compromise micronutrient intakes. Therefore, rather than over-emphasis on restriction of sucrose during weight loss, moderate levels of sucrose intake should be encouraged, and more emphasis should be placed on the education of individuals regarding ways to achieve a low-fat diet and ways to prevent inadequacies of important nutrients such as calcium, iron and folate.

Drummond & Kirk TR (1999). Public Health Nutrition. 2, 187-197.

McCreery C (1991). Proceedings of the Nutrition Society. 50, 223A.

RDA Working Group. Food Safety Authority of Ireland (1999) *Recommended Dietary Allowances for Ireland*. Dublin: FSAI.

West JA & de Looy AE (2001). International Journal of Obesity. 18, 820-828.

Tracking of energy and macronutrient intakes from adolescence to young adulthood: the Young Hearts project, Northern Ireland. By A.M. GALLAGHER¹, P.J. ROBSON¹, A.J. LONG¹, G.W. CRAN², J.I. STRAIN¹, L.J. MURRAY², J.M. SAVAGE³ and C.A.G. BOREHAM⁴, ¹Northern Ireland Centre for Diet and Health (NICHE), University of Ulster, Coleraine BT52 1SA, ²Department of Epidemiology and Public Health, Queen's University, Belfast BT12 6BJ, ³Department of Child Health, Queen's University, Belfast, BT12 6BJ and ⁴School of Applied Medical Sciences and Sports Studies, University of Ulster, Jordanstown BT37 0QB

The assumption that dietary patterns formed in early life track into adulthood has been cited as the rationale for targeting 'healthy eating' programmes at children and adolescents. The aim of the present study was to evaluate the extent to which intakes of energy and micronutrients track between adolescence and young adulthood using a random sample of boys (*n* 231) and girls (*n* 231) at adolescence (aged 15 years), and subsequently at young adulthood (22 (SD 1.6) years) who participated in the Young Hearts project, Northern Ireland (Boreham *et al.* 1993; Gallagher *et al.* 2002).

On both occasions, food intakes were assessed by the diet history method. Macronutrient intakes were expressed as a percentage of total energy intake. The Wilcoxon matched-pairs signed-ranks test was used to test for significant differences between median intakes reported at adolescence and, subsequently, at young adulthood (see Table). Patterns of energy and macronutrient intakes were considered to track well at the individual level if subjects' tertile ranking at adolescence was maintained when at young adulthood. The degree of tracking was estimated using weighted kappa statistics (κ) and interpreted according to Altman (1991): $\kappa \leq 0.20$, poor; $\kappa 0.21-0.40$, fair; $\kappa 0.41-0.60$, moderate; $\kappa 0.61-0.80$, good; $\kappa 0.81-1.00$, very good.

Nutrient	Boys (<i>n</i> 245)						Girls (<i>n</i> 231)					
	Adolescence			Young adulthood			Adolescence			Young adulthood		
	Median	25 th	75 th	Median	25 th	75 th	Median	25 th	75 th	Median	25 th	75 th
TEI (MJ/d)	13.2	11.3	15.2	12.4	10.4	15.4	9.0	7.6	10.7	8.1***	6.9	9.7
TEI (MJ/kg/d)	0.23	0.19	0.26	0.17***	0.14	0.21	0.16	0.13	0.20	0.13***	0.11	0.16
Protein (%TEI)	11.8	10.5	13.2	13.0***	11.5	14.5	11.2	10.2	12.8	13.9***	12.0	15.6
CHO (%TEI)	51.2	48.1	54.7	47.5***	42.3	52.3	51.7	48.3	54.7	50.9	46.9	55.1
Total fat (%TEI)	38.3	35.0	41.1	32.3***	29.5	36.4	38.7	36.0	41.7	33.1***	29.7	37.1
SFA (%TEI)	15.0	13.4	17.0	11.0***	9.2	13.0	14.4	13.0	16.1	10.4***	8.6	12.5
MUFA (%TEI)	12.5	11.3	13.8	10.4***	8.9	11.8	12.2	10.9	13.6	9.8***	8.4	11.5
PUFA (%TEI)	5.5	4.4	7.0	5.1***	3.9	6.5	6.1	4.7	7.7	5.5**	4.3	7.1

Median intake at adolescence was significantly different from median intake at young adulthood, ***P* < 0.01, ****P* < 0.001.

TEI, total energy intake; CHO, total carbohydrate; SFA, saturated fat; MUFA, monounsaturated fat; PUFA, polyunsaturated fat.

With the exception of carbohydrate intake in girls, the percentage contribution of macronutrients to total energy intakes change from adolescence to young adulthood. However, the tracking coefficients were poor ($\kappa < 0.25$ for energy and all macronutrients), indicating substantial drift of subjects among the low, medium and high classes of intake with increasing age. The poor to fair tracking reflects previous findings in this cohort between age 12 and 15 years (Robson *et al.* 2000), and suggests that individual dietary patterns exhibited at 15 years of age are unlikely to be predictive of dietary intakes at young adulthood.

Altman DG (1991) *Practical Statistics for Medical Research*. London: Chapman and Hall.

Boreham C, Savage JM, Primrose D, Cran G & Strain J (1993) *Archives of Disease in Childhood* **68**, 182-186.

Gallagher AM, Savage MJ, Murray LJ, Davey Smith G, Young IS, Robson PJ, Neville CE, Cran G, Strain JJ & Boreham CA (2002) *Public Health* (in press).

Robson PJ, Gallagher AM, Cran GW, Livingstone MBE, Strain JJ, Savage M & Boreham CAG (2000) *British Journal of Nutrition* **84**, 541-548.

Compliance, acceptability and carbohydrate knowledge in healthy overweight volunteers, maintained on low-sucrose (5% energy) and sucrose-containing (10% energy), weight-reducing diets. By R.T. HANNON^{1,2} and M. MOLONEY², *University of Dublin, Trinity College Dublin, Republic of Ireland and ²School of Biological Sciences, Dublin Institute of Technology, Kevin Street, Dublin 8, Republic of Ireland*

Weight reduction programmes have been largely unsuccessful in decreasing the prevalence of obesity (West & de Looy, 2001). Low-fat, high-carbohydrate diets have shown promising results of weight loss (Saris *et al.* 2000). However, diets high in complex carbohydrate are bulky and unpalatable when consumed over long periods of time. Therefore the inclusion of moderate amounts of sucrose in weight-reducing diets may be successful in promoting compliance to higher carbohydrate intakes on weight reduction programmes (West & de Looy, 2001).

This study examined the compliance and palatability of low-fat, weight-reducing diets containing 5% and 10% sucrose energy (low-sucrose diet (LSD) and sucrose-containing diet (SCD) respectively). The subjects' attitudes to carbohydrate and sugar were also ascertained, as there is a commonly held opinion that it is sugary foods that promote overweight and obesity (Drummond & Kirk, 1998).

In this cross-over study, all subjects completed 2 weeks on both the 5% and 10% sucrose energy diets. Sixty-one subjects (males n 35, females n 26) aged between 25 and 60 years were recruited from the staff of both the Dublin Institute of Technology and St. Vincent's Hospital, Fairview, Dublin 3. Subjects were divided into two groups and matched for sex and BMI across groups.

	5% sucrose energy diet (n 61)		10% sucrose energy diet (n 61)	
	Mean	SD	Mean	SD
Weight loss (kg)	1.0	1.2	1.3	1.2
Reported energy consumed (kcal)	1691	459	1622	342
Reported sucrose energy consumed (%)	5.44	3.6	8.5	4.3
Reported sucrose intake (g)	24.1	17.7	34.6	19.1
Reported fat energy consumed (%)	25.6	8.0	24.6	7.4

Total mean weight loss on the 10% sucrose energy diet was greater than that on the 5% sucrose energy diet although this was not significant. Subjects complied better with the 5% sucrose energy diet than with the 10% sucrose energy diet. The difference between prescribed and reported sucrose intakes on the 5% sucrose energy diet did not differ significantly. When compliance was evaluated by sex, males reported better compliance with the 10% sucrose energy diet than the females. The total energy and percentage of energy from fat decreased significantly from baseline on both diets ($P < 0.001$). On the questionnaire, 50% of males and 32% of females agreed with the statement "eating sugar is one of the main causes of obesity". In addition, 61% and 67% of participants said it was "very easy" or "easy" to adhere to the LSD and SCD, respectively, with 54% and 56% rating the LSD and SCD, respectively, as "tasty" or "very tasty". Adherence and palatability did not differ significantly between the diets. Subjects reported a more significantly improved quality of life on the SCD than on the LSD ($P < 0.01$).

The subjects' misconceptions regarding the link between sugar and obesity are reflected in the finding that compliance to the LSD was better than that to the SCD. It would be interesting to examine whether or not adherence and palatability would have differed significantly between the diets, had the subjects complied with the SCD.

Drummond S & Kirk T (1998) *Journal of Human Nutrition and Dietetics* **11**, 473–485.
Saris WHM, Astrup A, Prentice AM, Zunft HJF, Fomigueras X, Verboeket-van de Venne WPHG, Raben A, Poppitt SD, Seppelt B, Johnson SD, Vasiliaras TH & Keogh GF (2000) *International Journal of Obesity* **24**, 1310–1318.
West JA & de Looy AE (2001) *International Journal of Obesity* **25**, 1122–1128.

Intakes of saturated, monounsaturated and polyunsaturated fat in Irish adults: findings of the North/South Ireland Food Consumption Survey. By A.J. WALLACE¹, S.N. MCCARTHY² and M.J. GIBNEY¹, *Irish Universities Nutrition Alliance (IUNA), ¹Department of Clinical Medicine, Trinity College Dublin, Republic of Ireland and ²Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

Cardiovascular disease and cancer are among the leading causes of mortality in Republic of Ireland and Northern Ireland (British Heart Foundation, 1999; Central Statistics Office, 2000). As more has become known about the role of dietary fat in these diseases, dietary recommendations are focusing less on limiting total fat intake and more on limiting saturated fat intake and increasing intakes of monounsaturated and polyunsaturated fat. The North/South Ireland Food Consumption Survey (NSIFCS) is the first survey to measure intakes of saturated, monounsaturated and polyunsaturated fatty acids in a representative sample of Irish adults. Levels of saturated, monounsaturated and polyunsaturated fatty acids in foods previously undetermined were obtained to give a more accurate representation of these fatty acids in the Irish diet.

	Total population (n 1379)		Male (n 662)		Female (n 717)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
% total energy from total fat	35.4	(5.7)	34.9*	(5.7)	35.8	(5.7)
Saturated	13.7	(3.2)	13.6	(3.2)	13.8	(3.2)
Monounsaturated	11.8	(2.2)	11.8	(2.2)	11.9	(2.2)
Polyunsaturated	7.1	(2.2)	6.8**	(2.1)	7.3	(2.2)

*Significantly different between men and women, ** $P < 0.001$.

The mean percentage contributions of total fat and saturated fat to total energy in the Irish diet were higher than the current dietary recommendations of $< 33\%$ and $< 10\%$ total energy, respectively (Department of Health, 1991). In this population group, 31% met the dietary recommendation for fat, 11% met the dietary recommendation for saturated fat, 50% met the dietary recommendation for monounsaturated fat ($\geq 12\%$ total energy) and 68% met the dietary recommendation for polyunsaturated fat ($\geq 6\%$ total energy).

In the Irish diet, the main contributors to saturated fat intake were meat and meat products (21%); butter, spreading fat and oils (18%); milks and yoghurts (14%) and cakes, pastries and biscuits (11%). These food groups were also the main contributors to monounsaturated fat in the diet, with meat and meat products making a 28% contribution, whilst butter, spreading fat and oils made the biggest contribution to polyunsaturated fat intake (24%).

The population was divided into two groups, a group defined as compliers (n 392), who had a group mean equal to the dietary target for saturated fat, and a group defined non-compliers (n 987), whose group mean was greater than the dietary target for saturated fat. Intakes of fruit, vegetables and fish were significantly higher in the compliers group than the non-compliers group, whilst intakes of meat and meat products, milk and yoghurts, cheeses and fats and oils were significantly lower in the compliers group than in the non-compliers group. Complifiers also consumed significantly less total energy ($P < 0.001$), less total energy from total fat ($P < 0.001$) and polyunsaturated fat ($P < 0.05$) and more total energy from monounsaturated fat ($P < 0.001$). Complifiers were significantly older than individuals who did not comply with the dietary targets for saturated fat ($P < 0.05$). By examining the characteristics and eating patterns of individuals who comply with current dietary recommendations for total fat, saturated, polyunsaturated and monounsaturated fat, it is possible to gain an insight into strategies that will be most effective in implementing dietary change in the population. Further work will be carried out in this population, which will ultimately lead to the development of food-based dietary guidelines for fat and fatty acids.

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British Heart Foundation (1999) *Coronary Heart Disease Statistics*. British Heart Foundation Statistics 1999. London: British Heart Foundation.

Central Statistics Office (2000) *Vital Statistics 4th Quarter and Yearly Summary* 1999. Dublin: CSO.

Department of Health (1991) *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy. London: HMSO.

The impact of ready to eat breakfast cereals (RTEBCs) on the level of inadequacy of micronutrients and non-compliance with dietary recommendations in Irish adults. By M.A. GALVIN, M. KIELY and A. FLYNN, *Irish Universities Nutrition Alliance, Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

This study was based on analysis of data from the North/South Ireland Food Consumption Survey in a representative sample of 1379 Irish adults aged 18-64 years (662 men, 717 women). A 7 d food diary was used to collect food intake data and nutrient intakes were estimated using McCance and Widdowson's data (Holland *et al.* 1995) plus nutrient data collected on generic Irish foods. Men and women consumers were classified by tertile of ready-to-eat breakfast cereal (RTEBC) consumption (g/d) into low, medium and high. The average requirement (AR) was used as a cut-off point to estimate the percentage of the population subgroup with inadequate micronutrient intake (Carriquiry, 1999).

RTEBC consumers*	% Not achieving dietary recommendations							
	Men				Women			
	None (n 225)	Low (n 146)	Medium (n 147)	High (n 144)	None (n 225)	Low (n 162)	Medium (n 170)	High (n 160)
Total fat (≥55% E ^a)	74	69	63	60	81	67	64	44
Carbohydrate (≥50% E ^b)	83	81	71	67	86	77	70	57
NSP (≥18 g)	72	73	67	40	95	87	86	65

Fortified RTEBC consumers*	% With intakes below the average requirement (AR)							
	Men				Women			
	None (n 265)	Low (n 132)	Medium (n 133)	High (n 132)	None (n 267)	Low (n 143)	Medium (n 155)	High (n 152)
Calcium 500 mg	15	9	10	3	33	20	21	10
Iron 7 mg (10 mg 18-50 years, 6 mg, 51-64 years)	5	2	0	0	55	47	31	12
Riboflavin 1.3 mg (1.1 mg)	21	14	5	2	38	20	11	0
Folate 140 µg	5	2	1	0	19	5	4	1
Vitamin C 30 µg	9	11	8	2	15	7	5	4

*RTEBC consumers: Low consumers ≤16.4 g/d (men), ≤14.3 g/d (women); medium consumers >16.4-35.7 g/d (men), >14.3-30 g/d (women); high consumers >35.7 g/d (men), >30.0 g/d (women).

Increased RTEBC consumption was associated with a replacement of food energy from fat with food energy from carbohydrate and with greater compliance with recommendations for fat, carbohydrate and non-starch polysaccharide (NSP). Increased consumption of fortified RTEBC was associated with a reduced level of micronutrient inadequacy for calcium, iron, riboflavin, and folate in women particularly. Although this association is confounded by energy intake, nutrient density for these macronutrients and NSP increased with increasing consumption of RTEBCs. Overall, the consumption of RTEBCs was associated with a more balanced diet in relation to fat, carbohydrate and NSP and with a reduced level of inadequacy for calcium, iron, riboflavin and folate, particularly in women.

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Carriquiry AL (1999) Assessing the prevalence of nutrient inadequacy. *Public Health Nutrition* 2(1), 23-33.
Department of Health (1991) *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy*. London: HMSO.
Holland B, Welch AA, Unwin ID, Buss DH, Paul AA & Southgate DAT (1995) *McCance & Widdowson's The Composition of Foods, 5th Edition*. Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Food, London: HMSO.
Scientific Committee for Food (1993) *Nutrient and Energy Intakes for the European Community*. Luxembourg: Office for Official Publications of the European Communities.

Characteristics of nutritional supplement users versus non-users. By E.N. NEWMAN, E.M. HANNON, M. KIELY and A. FLYNN, *Irish Universities Nutrition Alliance, Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

Nutritional supplement use in the North/South Ireland Food Consumption Survey was assessed using a self-administered questionnaire and respondents also entered each supplement as it was consumed into a 7 d food diary. Almost a quarter of respondents consumed supplements during the recording week. Twice as many women as men consumed supplements and adequacy of micronutrient intakes was better in supplement users than non-supplement users (Kieley *et al.* 2001).

In the current analysis the characteristics of supplement users and non-users were examined including anthropometric measurements, compliance with dietary recommendations, fruit and vegetable intakes, and smoking status.

	Supplement users				Non-users			
	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)
	n 103	n 228	n 510	n 470				
BMI category								
Normal (18.5-24.9 kg m ⁻²)	37	58	33	47				
Overweight (25-29.9 kg m ⁻²)	47	30	46	34				
Obese (≥30 kg m ⁻²)	17	12	21	18				
Waist circumference* (Han <i>et al.</i> 1995; Lean <i>et al.</i> 1995)	n 81	n 205	n 411	n 423				
Normal risk (<80 cm)	52	59	53	49				
Increased risk (80-87.9 cm)	25	24	24	24				
High risk (≥88 cm)	24	17	23	27				
Waist/hip ratio* (Croft <i>et al.</i> 1995)								
Normal risk (<0.80)	74	62	79	56				
Increased risk (≥0.80)	26	39	21	44				
Compliance with dietary recommendations	n 112	n 232	n 550	n 485				
Food energy from fat <=35%	41	38	31	33				
Food energy from carbohydrates >=50%	26	28	22	26				
Currently smoke	23	27	36	35				
Fruit and vegetable intakes								
Mean (SD) daily fruit intake (g/d)	168 (151)	176 (162)	126 (147)	122 (118)				
Mean (SD) daily vegetable intake (g/d)	159 (80)	145 (75)	147 (77)	126 (63)				

*Risk of development of CVD risk factors

A higher percentage of supplement users were in the normal BMI category and a lower percentage were in the overweight and obese BMI categories compared with non-users. A higher proportion of women users were in the normal waist circumference and waist/hip ratio risk categories and a lower proportion were in the high or increased risk categories, compared with non-users. In both men and women supplement users, a higher proportion complied with the dietary recommendation of obtaining ≤35% of food energy from fat than non-users. Mean daily fruit intakes were higher in users than non-users, and in women users, mean daily vegetable intakes were higher than in non-users. Fewer users than non-users smoked.

Nutritional supplement use is an indicator of other health promoting behaviours.

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Croft JB, Keenan NL, Sheridan DP, Wheeler FC & Speers MA (1995) *Journal of the American Dietetic Association* 95, 60-64.
Han TS, Van Leer EM, Seidell DP & Lean MEJ (1995) *British Medical Journal* 311, 1401-1405.
Kieley M, Flynn A, Harrington KE, Robson PJ, O'Connor N, Hannon EM, O'Brien, Bell S & Strain JJ (2001) *Public Health Nutrition* 4(5A), 1089-1097.
Lean MEJ, Han TS & Morrison CE (1995) *British Medical Journal* 311, 58-61.

Where are we eating? Analysis of the number of eating occasions at various locations, with emphasis on the food service sector. By N.A. O'DWYER, S.N. MCCARTHY, S.J. BURKE, A.J. WALLACE and M.J. GIBNEY, *Irish Universities Nutrition Alliance, Department of Clinical Medicine, Trinity College Dublin, Republic of Ireland*

The food service sector (FSS) has increased in importance in Ireland in recent years. The proportion of food expenditure spent on foods eaten outside the home increased from 15.6% to 19% between 1994/95 and 1999/2000 (CSO, 1995, 2000). In addition, the most recent data on the FSS from the North/South Ireland Food Consumption Survey (NSIFCS) showed that 24% of total energy came from foods eaten outside the home (IUNA, 2000).

The NSIFCS data were further investigated to give a better insight into where the population of the Republic of Ireland (n 958) was eating and the demographic profile of these consumers. Initial work analysed the differences between eating at home, at work and eating out. The location of defined based on where the food was prepared rather than eaten. Further analysis was carried out on the "out" locations. These are pub/ hotel/ restaurant/ social function, deli/ coffee shop/ shop bought/ sandwich bar and take-away/ cinema.

Every respondent ate at home at least once during the week, 69% of males and 57% of females had at least one eating occasion at work during the week and 87% of men and 85% of women ate out at least once during the week. The analysis of the out locations showed that 78% of males and 70% of females had at least one eating occasion in a pub/restaurant during the week, 39% of males and 50% of females ate in a deli/coffee shop at least once in the week and 35% of males and 28% of females ate in a take-away/cinema during the week.

Location	Male			Female		
	18–35 y	36–50 y	51–64 y	18–35 y	36–50 y	51–64 y
	Mean number of eating occasions at each location					
Home	20.9 ^a	24.6 ^a	25.4 ^a	23.2 ^a	28.2 ^a	28.9 ^b
Work	7.7 ^a	7.6 ^a	5.1 ^b	8.0 ^a	6.9 ^a	6.4 ^a
Out	9.2 ^a	6.2 ^b	6.2 ^b	6.3 ^a	4.1 ^b	3.4 ^b
Pub/restaurant	7.2 ^{ns}	5.3 ^b	5.8 ^b	4.8 ^a	3.3 ^b	2.9 ^b
Deli/coffee shop	3.0 ^a	2.3 ^{ab}	2.3 ^b	2.3 ^a	2.0 ^a	1.8 ^a
Take-away/cinema	1.9 ^a	1.3 ^b	1.3 ^b	1.3 ^{ns}	1.3 ^{ns}	1.2 ^{ns}

^a Across rows denotes significant difference at $P < 0.05$ for males and females separately; ns = non significant.

The mean number of eating occasions over the week by age and sex for consumers only are shown in the table above. Younger males and females had fewer eating occasions at home and more eating occasions out than the older groups. The number of eating occasions in pubs decreased with increasing age for females. Younger males have significantly more eating occasions in deli/coffee shops and take-away/cinemas than the older age groups. The mean number of eating out occasions has also been analysed by a number of other variables, including urban/rural location, marital status, BMI and social class. Urban women had significantly more eating occasions out ($P < 0.05$) than rural women. For both sexes, single people had significantly more eating occasions out ($P < 0.01$) than married people. Normal-weight women had more eating occasions out ($P < 0.05$) than overweight or obese women. Social class also influenced the number of eating out occasions but no particular pattern was evident.

This information on where the Irish population is eating highlights target groups for further analysis. This can be used in further work on contribution from the FSS to nutrient intake, the types of foods consumed by consumers in the FSS and the temporal pattern of food consumption in the FSS.

This project is funded by the Department of Agriculture, Food and Rural Development, Central Statistics Office (1995) *Household Budget Survey 1994/1995*. Cork: CSO.
Central Statistics Office (2000) *Household Budget Survey 1999/2000*. Cork: CSO.
Irish Universities Nutrition Alliance (IUNA) (2000) *NSIFCS Summary Report, March 2001*. www.iuna.net.

Cereal intake in Ireland and its potential use for food-based dietary guidelines. By S.J. BURKE, S.N. MCCARTHY, N.A. O'DWYER, A.J. WALLACE and M.J. GIBNEY, *Irish Universities Nutrition Alliance, Department of Clinical Medicine, Trinity College Dublin, Republic of Ireland*

Analysis of the North/South Ireland Food Consumption Survey (NSIFCS) has shown that cereal products make a substantial contribution to macronutrient, fibre, vitamin and mineral intakes in Ireland (Galvin *et al.* 2001; Hannon *et al.* 2001; Harrington *et al.* 2001; O'Brien *et al.* 2001). As cereal products are central to the Irish diet, further analysis of the role of cereal products in the Irish diet is warranted. For this work NSIFCS data were analysed for respondents from the Republic of Ireland only. This analysis aimed to examine cereal intake, its contribution to fibre and trends in temporal consumption of white and wholemeal bread as a basis for formulating food-based dietary guidelines.

	Consumers (%)	Total (n 958)		All males (n 475)		All females (n 483)	
		Mean	(SD)	Mean	(SD)	Mean	(SD)
White bread	93	78.8	(60.0)	97.2	(70.3)	60.7*	(40.4)
Wholemeal bread	76	50.5	(62.8)	58.8	(77.3)	42.3	(42.8)
Rice and pasta	58	27.5	(38.8)	26.8	(38.7)	28.3	(39.0)
Other breads	66	21.9	(29.9)	22.5	(33.4)	21.3	(25.9)
Other breakfast cereals	18	20.5	(59.8)	23.0	(70.3)	18.0	(47.2)
Ready to eat breakfast cereals	66	18.7	(23.5)	20.4	(26.2)	17.1	(20.4)
Cakes pastries and buns	60	17.8	(25.4)	19.0	(29.2)	16.6	(21.1)
Biscuits	79	15.0	(18.6)	16.4	(22.4)	13.6	(13.7)
Total cereals	100	250.7	(116.4)	284.1	(132.6)	217.9*	(86.3)

* Denotes significant differences between intakes for men and women, $P < 0.001$.

White and wholemeal breads were consumed by a high proportion of the population and made the greatest contribution to overall cereal intake. Cereal products contributed to almost 45% of the dietary fibre in the diet; white and wholemeal bread contributed to 16% and 13% of the mean daily intake of dietary fibre, respectively, followed by breakfast cereals at 7%, and the remaining cereal products at 9%.

Temporal analysis on the consumption of cereals has shown an overall decrease in the consumption of both white and wholemeal bread at the weekend. Trends have also shown that during the day, consumption of white and wholemeal bread peak in the morning, in the early afternoon and early evening.

73% of the population did not comply with the recommended mean daily intakes of 30 g of dietary fibre (Galvin *et al.* 2001). Food-based dietary guidelines must be established to increase fibre intake in the Irish population, and so help decrease the risk of impaired bowel function and constipation. These guidelines could be targeted at increasing the overall consumption of cereal products with particular focus on increasing consumption of bread at weekends as well as the substitution of wholemeal bread for white bread at meal times. Further analysis of the IUNA database must be carried out in order to formulate effective food-based dietary guidelines to increase fibre intakes for specific subgroups of the population.

This project was funded by the Department of Agriculture, Food and Rural Development, Dublin.

Galvin MA, Kiely M, Harrington KE, Robson PJ, Strain JJ & Flynn A (2001) *Public Health Nutrition* 4, 1061–1068.
Hannon EM, Kiely M, Harrington KE, Robson PJ, Strain JJ & Flynn A (2001) *Public Health Nutrition* 4, 1081–1088.
Harrington KE, McGowan MJ, Kiely M, Robson PJ, Livingstone MBE, Morrissey PA & Gibney MJ (2001) *Public Health Nutrition* 4, 1051–1060.
O'Brien MM, Kiely M, Harrington KE, Robson PJ, Strain JJ & Flynn A (2001) *Public Health Nutrition* 4, 1069–1080.

Relationship between carbonated soft drink intake and bone mineral density in Northern Irish adolescents: the Young Harts project. By C.P. MCGARTLAND¹, P.J. ROBSON², L. MURRAY³, J.M. SAVAGE⁴ and C.A.G. BOREHAM¹, ¹Young Harts Project, University of Ulster, Jordanstown, BT37 0QB, ²Northern Ireland Centre for Diet and Health (NICHE), University of Ulster, Coleraine, BT52 1SA, ³Department of Epidemiology and Public Health, The Queen's University of Belfast, BT12 6BJ and ⁴Department of Child Health, The Queen's University of Belfast, BT12 6BJ

The growth period during adolescence is a critical time for bone development (Bailey *et al.* 2000). It has been suggested that high consumption of carbonated soft drinks (CSD) during adolescence may increase fracture risk (Wysihak, 2000), and reduce bone mineral accrual (Whiting *et al.* 2001). The aim of the present study was to examine the relationships between CSD consumption and bone mineral density (BMD) at the non-dominant forearm and dominant heel (os calcis) in 12-year-olds (boys, *n* 324; girls, *n* 378) and 15-year-olds (boys, *n* 274; girls, *n* 369) randomly selected from post-primary schools in Northern Ireland. BMD was determined by dual energy x-ray absorptiometry using a portable (PIXI) bone densitometer. Usual beverage consumption and nutrient intakes were assessed by the diet history method. CSD were defined as all non-alcoholic carbonated drinks, and intakes were expressed in g/d. Height and weight were measured in all subjects, and questionnaires were used to assess length of time exposed to oestrogen (females only), smoking habit (1165 non-smokers, 173 smokers), usual alcohol consumption, physical activity patterns and parental socio-economic status. A paediatrician measured pubertal stage by visual assessment of secondary sexual characteristics.

	Boys (<i>n</i> 598)				Girls (<i>n</i> 747)			
	12-year-olds		15-year-olds		12-year-olds		15-year-olds	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Height (cm)	152.3	7.6	172.1	7.6	153.9	6.9	162.6	5.7
Weight (kg)	45.8	10.4	62.4	12.8	48.1	10.5	58.0	10.3
Physical activity score ^a	31.9	15.8	28.4	14.8	22.6	13.7	18.2	12.8
BMD forearm (g/cm ²)	0.336	0.05	0.387	0.06	0.326	0.06	0.408	0.06
BMD os calcis (g/cm ²)	0.469	0.08	0.557	0.09	0.450	0.08	0.489	0.08
Total energy intake (MJ/d)	12.0	3.6	13.5	3.9	10.4	3.2	10.2	3.4
Calcium intake (mg/d)	1045	394	1148	436	884	316	865	344
CSD intake (g/d)	459	394	518	452	351	332	340	380

^a Highest possible physical activity score = 100.

The relationship between CSD consumption and BMD at both measurement sites was assessed using multiple regression analysis, adjusting for potential confounding factors (height, weight, age, tobacco use, alcohol consumption, pubertal status, calcium intake, physical activity score and socioeconomic status). In females, CSD consumption was significantly negatively associated with BMD measured at the dominant os calcis ($\beta = -0.108$, $P = 0.00$). A negative effect was also observed at the non-dominant forearm, but the relationship did not reach statistical significance ($\beta = -0.051$, $P = 0.10$). In males, there were no significant associations between CSD intake and BMD at either measurement site. CSD consumption appears to have adverse effects on the BMD of females aged 12 and 15 years. It is possible that the apparent association results from the displacement of more nutritious beverages from the diet. This finding may have important public health implications, but further research is required to confirm the association.

This work was supported by the DHSSPS (NI).

Bailey DA, Martin AD, McKay HA, Whiting S & Mirwald R (2000) *Journal of Bone and Mineral Research* **15**, 2245-2250.

Whiting S, Healey A, Psak S, Mirwald R, Kowalski K & Bailey DA (2001) *Nutrition Research* **21**, 1107-1115.

Wysihak G (2000) *Archives of Pediatric Adolescent Medicine* **154**, 610-613.

Adolescents talking about food and health: a focus group approach. By M. MORRISSEY, M.C. MCKINLEY, C. LOWIS, P.J. ROBSON, A. MORAN and M.B.E. LIVINGSTONE, *Northern Ireland Centre for Diet and Health (NICHE), University of Ulster, Coleraine, BT52 1SA*

Nutritional intake during adolescence is important for growth, long-term health promotion, and the development of lifelong eating behaviours (Story & Alton, 1996). Inappropriate dietary behaviours, once established, are extremely difficult to change and may give rise to diet-related chronic diseases in later life. Research shows that cognitive-focused curricula generally result in increased knowledge, but knowledge alone is not sufficient to bring about change in behaviour and attitudes (Contento *et al.* 1995). It therefore appears likely that future nutrition-based educational programmes must also focus on behaviour in an effort to bring about change in dietary intake.

The purpose of this study was to gather baseline information to determine the nature of the content, the activities and the issues to be developed in an interactive multimedia CD-ROM for the promotion of nutrition education in second-level schools. Using focus groups, a technique for data collection via group interaction, sixteen focus group sessions (two in each school) were conducted with pupils aged 12-13 years (*n* 160) from eight schools located in urban, suburban and rural areas in Ireland. Schools were selected to represent the range of socio-economic status, school type and academic ability. Each focus group session lasted 30-40 min. The aim was to gain insight into the everyday lifestyle of adolescents, and to identify nutrition issues and aspects of diet and health that they considered important and motivating. Sessions were audiotaped, tapes were transcribed verbatim following each focus group session, and transcripts were analysed using the "cut and paste" technique of Stewart & Shamdasani (1990), which enables researchers to categorize the responses of the focus group participants.

Results show that pupils are quite conservative, spend 1-5 h per night watching television, are ambitious, competitive and like to be rewarded. Major changes in dietary patterns were reported to occur in the transition from primary to secondary school. Guilt and bloating were associated with food intake, along with some disturbing food-related behaviours in relation to body image. Taste, filling power, appearance, cost, time, choice, availability and peer pressure were identified as barriers to healthy eating. Many did not associate vitamins with food, but rather referred to them in terms of pills and medicines. Reasons for eating other than hunger included boredom, time and comfort.

In conclusion, findings from the focus group discussions identified the following as areas that needed to be addressed: the influence of the mass media, dichotomization of food, food choices, barriers to healthy eating, peer pressure, body image and physical activity. Tailoring nutrition education to the behaviours, needs and beliefs of the target audience may prove to be more effective than traditional knowledge-based approaches.

Contento I, Balch GI, Bronner YL, Lytle LA, Maloney SK, Olson CM & Swadener SS (1995) *Journal of Nutrition Education* **27**, 298-311.

Stewart DW & Shamdasani PN (1990) *Focus Groups: Theory and Practice*. Newbury Park, CA: Sage Publications.

Story M & Alton I (1996) *Topics in Clinical Nutrition* **11**, 56-69.

The effect of inter-generational social and regional circumstances on dietary intake patterns of British adults: results from the 1946 Birth Cohort. By G.D. MISHRA¹, A.A. PAUL¹, D.C. GREENBERG¹, M.E.J. WADSWORTH² and C. BOLTON-SMITH¹, ¹MRC Human Nutrition Research, Elsie Widdowson Laboratory, Fulbourn Road, Cambridge, CB1 9NL and ²MRC National Survey of Health and Development, University College and Royal Free Medical School, 1–19 Torrington Place, London WC1E 6BT

Previous research has indicated clear variations in mortality rates and the incidence of diet-related diseases across social class and geographical regions in Britain (Bartley *et al.* 2000). Whilst some of these differences in health have been attributed to nutrition in early life, influences of adult diet are also important. Dietary patterns tend to vary by social class and region of residence; however, it is unclear to what extent social and regional mobility influence dietary patterns in adulthood.

This study examined the effect of inter-generational social and regional mobility on dietary patterns in adulthood in the MRC National Survey of Health and Development (1946 birth cohort). The cohort is a social-class stratified random sample of 5362 singleton births in Britain during the first week of March 1946. In 1989, when the participants were 43 years of age, research nurses collected data on health, family and lifestyle, including a 48-h recall of all food and drinks consumed (*n* 3187). The diet records were coded (Price *et al.* 1995) and analysed using in-house programs. Social class mobility of participants was derived from social circumstance at age 4 years, based on their father's social class, and their own occupational social class at age 43 years.

This analysis employed the multivariate methodology of factor analysis to identify dietary patterns (Mishra *et al.* 2002). Multiple linear regression was used to model the relationships between dietary patterns and inter-generational social/regional circumstances. A mean factor score of 0 indicated average consumption of food items associated with that factor.

Factor analyses revealed five dietary patterns: *health aware* (items include high fibre breakfast cereals, wholemeal bread, apples, bananas); *dinner party* (coffee, red wine, cream); *traditional* (potatoes, carrots, red meat, peas); *energy dense* (whole milk, sugar, butter, white bread); *convenience* (tomatoes, lettuce, onions, bacon, ham).

Inter-generational social class	Adjusted* factor means and 95% confidence intervals for dietary intake patterns			
	Own	Men (n 1324)	Women (n 1242)	
Father's				
Manual	Manual	Health aware ^a	Dinner party ^a	Health aware ^a
Non-manual	Manual	-3.5 (-4.5, -2.5)	-3.8 (-4.7, -2.9)	-4.2 (-5.4, -3.0)
Non-manual	Non-manual	-1.9 (-3.8, 0.0)	-3.0 (-4.9, -1.2)	-0.3 (-2.5, 1.8)
Non-manual	Non-manual	0.0 (-1.0, 1.0)	0.8 (-0.2, 1.7)	-0.5 (-1.4, 0.4)
P value	Non-manual	2.9 (2.0, 3.7)	4.2 (3.4, 5.1)	3.7 (2.8, 4.6)
		<0.0001	<0.0001	<0.0001

*Adjusted for inter-generational regional circumstances, significant difference in factor means across social class.

People who remained in the non-manual classes consumed above average amounts of food items correlated with the factors *health aware* and *dinner party* while those who remained in the manual classes consumed below average amounts. Those who made the transition from manual in childhood to non-manual at age 43 showed an intermediate position.

Changes in region of residence were strongly associated with the factors *dinner party* and *traditional* ($P < 0.0001$) among men, but only with the factor *traditional* ($P = 0.02$) among women. Men who had moved from Wales, Central and South West to London and South East, took on the dietary patterns (*dinner party*, *traditional*) of their adopted region of residence (results not shown). Factors *energy dense* and *convenience* did not differ by social class or region of residence.

This work suggests that although adult dietary patterns are developed as a result of childhood influences, these patterns can be modified as a result of social and regional transitions. Such changes in dietary patterns may influence susceptibility to disease. Understanding the nature of these transitions and their associated disease risks will assist in the formulation of food-based dietary recommendations and practical public health advice.

Bartley M, Fitzpatrick R, Firth D & Marmot M (2000) *Journal of Epidemiology and Community Health* **54**, 806–814.
Mishra G, Ball K, Aruckle J & Crawford D (2002) *Journal of Clinical Nutrition* (in press)
Price GM, Paul AA, Koy FB, Harter AC, Cole TJ, Day KC & Wadsworth MEJ (1995) *Journal of Human Nutrition and Dietetics* **8**, 417–428.

Social class influences on energy and macronutrient intakes reported by 12-year-old boys and girls participating in the Northern Ireland Young Hearts project: 1990 compared with 2000. By M.R. O'NEILL¹, P.J. ROBSON² and C.A.G. BOREHAM², ¹Northern Ireland Centre for Diet and Health (NICHE), University of Ulster, Coleraine, BT52 1SA and ²School of Applied Medical Sciences and Sports Studies, University of Ulster, Jordanstown, BT37 0QB

The nutritional quality of diets in childhood and adolescence may be influenced by social class (SC) (Gregory & Lowe, 2000). The aim of the present study was to examine SC-related differences in dietary intakes reported by 12-year-old boys and girls assessed in 1990, and to compare these with data obtained from a replicated study in 2000. As part of the Northern Ireland Young Hearts (YH) project, representative samples of subjects aged 12 years were randomly selected from post-primary schools in 1990 (YH1), and again in 2000 (YH2000). In both cohorts, height and weight were measured, and energy and nutrient intakes were assessed using the diet history method. Subjects were assigned to SC on the basis of their father's occupation, using the UK Registrar General's Occupational Scale (OPCS, 1991). Analysis of variance (ANOVA) was used to assess SC differences in anthropometric variables, and energy and nutrient intakes reported by subjects in each of the YH cohorts. For clarity, only mean values are included in the table below.

Boys		I						IV	V	P
		1990	2000	1990	2000	1990	2000			
2000 n 436	Height (m)	1.49	1.52	1.49	1.49	1.47	1.47	0.175		
	Weight (kg)	1.52	1.53	1.52	1.52	1.49	1.49	0.524		
	Weight (kg)	39.6	43.8	42.4	43.0	43.3	42.3	0.868		
	Weight (kg)	44.3	45.5	45.7	45.4	46.5	41.5	0.726		
	Energy (MJ)	10.2 ^a	11.3 ^a	11.9 ^a	11.9 ^a	14.9 ^b	14.9 ^b	0.000		
	Energy (MJ)	10.3 ^a	11.1 ^a	11.8 ^a	11.8 ^a	13.7 ^b	13.7 ^b	0.003		
Girls	Height (m)	12.9 ^a	11.6 ^a	10.9	10.7	10.9	10.6 ^b	0.000		
	Weight (kg)	12.0 ^a	12.1 ^a	11.4	11.2	10.5	10.4 ^b	0.000		
	Height (m)	1.52	1.52	1.53	1.5	1.51	1.49	0.475		
	Weight (kg)	1.53 ^a	1.56 ^a	1.54 ^a	1.53 ^a	1.46 ^b	1.46 ^b	0.000		
	Weight (kg)	42.9	44.7	46.1	43.8	43.7	44.3	0.862		
	Weight (kg)	46.3 ^a	49.9 ^a	48.3 ^a	47.8 ^a	46.5	40.6 ^b	0.027		
2000 n 428	Height (m)	8.0 ^a	8.6 ^a	8.6 ^a	10.1	10.4 ^b	9.2	0.004		
	Weight (kg)	9.2 ^a	9.9 ^a	10.4	10.6	9.5 ^a	11.8 ^b	0.023		
	Energy (MJ)	12.3 ^a	11.8 ^a	11.3	10.7	10.9	10.5 ^b	0.003		
	Energy (MJ)	12.6 ^a	11.6	11.3	11.1	11.2	10.7 ^b	0.012		
	Protein (%)									
	Protein (%)									

Values with different superscripts denote significant differences between social class groups.

In YH1, there were no significant SC-related differences in heights or weights of boys or girls. However, in YH2000, girls in SCV were significantly lighter than those in SCH, IINM and IIM whilst also being significantly shorter than girls in all other SC's. In YH1 and YH2000, boys in the lowest SC reported significantly higher energy intakes (El) than those in the higher SC's and a similar pattern emerged for girls. Patterns of protein intakes were similar in both cohorts, though significance levels decreased in 2000 for both boys and girls. There were no significant SC-related differences for total fat (% El) or carbohydrate (% El) intakes reported by both girls and boys in either cohort.

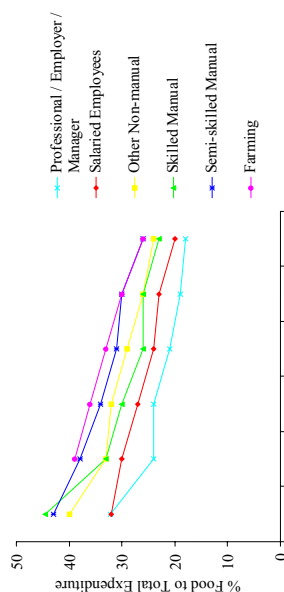
In YH2000, despite the fact that girls and boys in SCV reported significantly greater El than those in higher SCs, they were significantly lighter and shorter than other girls. This apparent paradox may be due to reporting bias, but further analysis is required to fully elucidate the relationships between SC and dietary intakes. It appears that social class continues to exert its influence over adolescent dietary patterns though the magnitude of these differences is decreasing.

Sponsored by DHSSPS (NI)

Gregory J & Lowe S (2000) *National Diet and Nutrition Survey: Young People Aged 4 to 18 Years*. London: HMSO.
Office of Population Censuses and Surveys (1991) *Standard Occupational Classification: Vol. 3*. London: HMSO.

Health and lifestyle inequalities: the emerging Ireland. By S. FRIEL, C.C. KELLEHER and G. NOLAN *National Nutrition Surveillance Centre, Centre for Health Promotion Studies, National University of Ireland, Galway, Republic of Ireland*

The level of health inequalities has developed in Ireland in a similar way as in other Western developed countries. Socially disadvantaged people suffer worse health outcomes, some dietary related, throughout life compared with others. Using the National Nutrition Survey of 1948 (1950) and Household Budget Survey data (1994), we can see marked social variation in household purchasing patterns over the interim time period (see Figure).



Social variations in household food expenditure

Fresh fruit and vegetables are more commonly purchased by higher socio-economic households, whereas the gradient is in the opposite direction for tinned and frozen fruit and vegetables. Individual consumption patterns also follow these trends. The first national health and lifestyle survey, Friel *et al.* (1999), was carried out in 1998 and collected lifestyle information, including dietary data, from over 6000 Irish adults. The same significant differential between high and low socio-economic groups in fruit and vegetable consumption was observed as that in household purchasing patterns.

Multivariate non-parametric classification tree analyses were used to profile and predict consumption of four or more servings of fruit and vegetables per day. Quite different patterns were observed for males and females, with a complex constellation of social support and socio-economic factors emerging for males, whereas the important factors for predicting the consumption of four or more servings of fruit and vegetables among females were strongly socio-economic in nature, i.e. medical card status, social class and education.

In conclusion, social gradients in purchasing and consumption patterns have been clearly identified in Irish adults, using two different methods. To ensure equitable access to healthy foodstuffs for all groups in the population, the necessary policies and actions need to be developed, based on sound scientific evidence and driven by a range of government departments. This empirical data should help facilitate focused action.

National Nutrition Survey (1950) Parts 1-4, 1948-1950. Dublin: Department of Health.
Household Budget Surveys (1994) Years 1951-1994. Ireland: Central Statistics Office.
Friel S, Nic Gabhainn S & Kelleher CC (1999) The national health and lifestyle surveys SLAN/HBSC. Galway: Centre for Health Promotion Studies.

Food poverty in rural Ireland. BY J. HARRINGTON and S. FRIEL, *National Nutrition Surveillance Centre, Centre for Health Promotion Studies, National University of Ireland, Galway, Republic of Ireland*

One of the main characteristics of poverty in rural Ireland is its seemingly invisible nature. Rural areas, unlike some urban areas, do not present homogeneous areas of advantage and disadvantage, they are diverse and the experience of poverty is often individual and dispersed over a greater geographical area. In many rural areas, disadvantage and marginalization remain significant problems. The present study is a collaborative project between the Centre for Health Promotion Studies, NUI, Galway and the Women's Education, Research and Resource Centre, UCD. Food poverty is defined as the inability to enjoy an adequate and nutritious diet impacts on both health and well-being of individuals and households as well as on the social behaviour of food-poor households and their members.

The SLAN dataset (Friel *et al.* 1999) was further analysed focusing upon rural respondents only. A total of 2798 respondents were classified as living in rural areas as determined by the Central Statistics Office. Respondents were grouped by differing degrees of 'rurality': those living in areas with populations of 0-500; 501-1000; 1001-1500 and >1501 inhabitants. The data were analysed according to the shelves of the food pyramid, to determine whether there were differences in food consumption patterns based upon the differing degrees of 'rurality'. Little variation was observed in dietary behaviour across the rural groups as a whole. There was, however, substantial variation within each group, as seen in the Table, which shows compliance or not with the food pyramid according to population density and social indicators such as gender, social class, etc. The most persistent social variation was observed in the consumption of fruit and vegetables, meat, fish and poultry, and foods from the top shelf of the food pyramid, and was predominantly in the areas with fewer inhabitants. Notably, there was a greater fruit and vegetable consumption in females than males across all categories of population density.

Significant social variations in food pyramid shelf compliance within rural groups

	Population density			
	0-500 n=1468	501-1000 n=890	1001-1500 n=122	1501+ n=318
Gender	Fruit and vegetables Meat, fish and poultry Top shelf	Cereal, bread & potato Fruit and vegetables Dairy	Fruit and vegetables	Fruit and vegetables Meat, fish and poultry
Number of children	Fruit and vegetables Meat, fish and poultry	Meat, fish and poultry Fruit and vegetables Meat, fish and poultry	Fruit and vegetables	
Age	Fruit and vegetables Dairy Meat, fish and poultry Top shelf	Fruit and vegetables Dairy Meat, fish and poultry Top shelf	Meat, fish and poultry	
Social class	Fruit and vegetables Meat, fish and poultry Top shelf	Fruit and vegetables Meat, fish and poultry Top shelf	Fruit and vegetables Dairy	Fruit and vegetables Meat, fish and poultry Top shelf
Number in household	Fruit and vegetables Meat, fish and poultry Top shelf	Fruit and vegetables Meat, fish and poultry Top shelf		
Marital status	Fruit and vegetables	Fruit and vegetables Dairy		Top shelf
Medical card status	Fruit and vegetables Meat, fish and poultry	Meat, fish and poultry Fruit and vegetables Dairy		Fruit and vegetables
Affluence level	Fruit and vegetables Meat, fish and poultry	Top shelf	Fruit and vegetables	
Education attained	Fruit and vegetables	Fruit and vegetables Top shelf		Fruit and vegetables Top shelf
Home tenure	Fruit and vegetables Meat, fish and poultry	Meat	Fruit and vegetables	Cereal, bread & potato Meat, fish & poultry
Employment				
Transport to shops	Fruit and vegetables Meat, fish and poultry		Fruit and vegetables	

Friel S, Nic Gabhainn S & Kelleher CC (1999) *Main Results of the National Health and Lifestyle Surveys, SLAN and HBSC*. Galway: Department of Health and Children Dublin and Centre for Health Promotion Studies.

Mean percentage body fat in relation to socio-demographic, lifestyle factors and physical activity in Irish adults. By C.M. MURPHY, M.A. GALVIN, M. KIELY and A. FLYNN, *Irish Universities Nutrition Alliance, Department of Food Science, Food Technology and Nutrition, University College Cork, Republic of Ireland*

The association between social factors, lifestyle, physical activity and mean percentage body fat (% BF) in Irish adults was examined using data from the North/South Ireland Food Consumption Survey. % BF was measured by bioelectrical impedance using the Bodystat 1500 analyser (Bodystat, Douglas, Isle of Man) in a representative sample of 1098 Irish adults aged 18–64 years (495 men, 603 women). Questionnaires were used to obtain information on social and demographic data, health and lifestyle data and physical activity data. SPSS (version 10.0; SPSS, Chicago) was used for statistical analysis. Tertile analysis was used to determine low, medium and high levels of alcohol intake, physical recreational activity and time spent watching TV. Data shown are for mean % BF in men and women separately in relation to smoking, alcohol, recreational activity and TV viewing.

	Percentage body fat					
	Men			Women		
	n	Mean	SD	n	Mean	SD
Smoking status						
Smoker	158	20.0	5.5	192	30.8	5.9
Ex-smoker	129	23.2	5.1	133	34.7	6.9
Non smoker	203	20.9	6.0	275	34.1	7.7
Alcohol (units/week)						
Low	129	21.2	5.6	157	34.7	6.8
Medium	138	20.9	5.3	173	31.8	7.0
High	138	20.3	5.7	159	31.2	6.4
All recreational activity (h/week)						
Low	149	22.8	6.0	190	34.9	7.0
Medium	165	20.7	5.3	193	32.4	7.2
High	176	20.3	5.7	214	32.4	7.1
TV viewing (h/d)						
Low	164	20.9	5.9	197	31.8	6.9
Medium	155	20.6	5.3	188	33.2	6.8
High	171	22.0	5.8	212	34.5	7.5

Alcohol (units/week): men, low ≤10.99, medium 11.0–23.99, high ≥24; women, low ≤4.99, medium 5.00–10.99, high ≥11.0.
Recreational activity (h/week): men, low ≤5.17, medium 5.18–11.99, high ≥12.0; women, low ≤3.09, medium 3.1–6.39, high ≥6.4.
TV viewing (h/d): men, low ≤1.99, medium 2.0–3.19, high ≥3.2; women, low ≤1.79, medium 1.8–2.99, high ≥3.00.

In this sample of adults, mean % BF was 21.2% in men and 33.2% in women and % BF increased significantly with increasing age (McCarthy *et al.* 2001). Age adjusted mean % BF was compared using analysis of covariance (ANCOVA). No significant difference in mean % BF was observed across different social class categories. Mean % BF decreased significantly ($P<0.01$) with increasing level of education in women only. In men mean % BF was highest in ex-smokers (NS); however, in women it was significantly ($P<0.05$) lower in smokers. In women who consumed alcohol, mean % BF was significantly higher ($P<0.05$) in those who consumed less than 5 units per week. In men mean % BF was significantly higher ($P<0.05$) among those with a low level of recreational activity (i.e. less than 5.17 h per week). Mean % BF was significantly higher ($P<0.05$) in men who spent 3.2 h per day or more watching TV. In women mean % BF increased significantly ($P<0.001$) with increasing time spent watching TV.

A lower mean % BF was associated with a greater level of recreational activity and with a shorter length of time watching TV. Factors such as smoking, alcohol intake and level of education were associated with % BF in women but not in men.

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McCarthy SN, Harrington KE, Kiely M, Flynn A, Robson PJ, Livingstone MBE & Gibney MJ (2001) *Public Health Nutrition* 4(5A), 1099–1106.

Evaluation of the *in vitro* antioxidant activity of wheat milling fractions. By R.K. BEATTIE¹, R.W. WELCH¹, A.M. LEE¹, J.I. STRAIN¹, K. O'SULLIVAN² and G.M. CAMPBELL^{1,3}, *¹School of Biomedical Sciences, University of Ulster, Coleraine, BT52 1SA, ²The Kellogg Company, Manchester M16 0PU and ³Satake Centre for Grain Process Engineering, UMIST, Manchester M60 1QD*

The FDA recently permitted an authoritative statement on the potential of whole-grain cereals to reduce the risk of coronary heart disease and certain cancers (FDA, 1999). One possible source of this protection is the antioxidant activity of the phytochemicals present, which may be active *in vivo*. Wheat, in particular, is known to have a significant antioxidant activity, with the phenolic acids concentrated in the outer portions of the kernel being the greatest contributor to this activity (Baublis *et al.* 2000a). The aim of this investigation is to further examine the *in vitro* antioxidant activity of wheat by evaluating wheat milling fractions.

Five milling fractions were obtained from the wheat cultivar Hereward using a laboratory Bühler mill. Moisture content was evaluated by the AOAC method. The total antioxidant activity (TAA) was evaluated on 50% aqueous methanol extracts using the ferric reducing ability potential (FRAP) (Benzie & Strain, 1996) and for total phenolic content (TPC) using the Singleton & Rossi (1965) method. Additionally, TAA was determined using the DPPH method (Miller *et al.* 2000).

	DPPH	mmol DPPH / 100g dry weight basis	Whole-grain	Coarse bran	Fine bran	Reduction flour	Break flour	Flour from bran finisher
Total antioxidant activity	FRAP	mg Ferulic acid eqs / 100g dry weight basis	2.45	5.97	7.58	2.49	1.35	5.04
(TAA)								
Total phenolic content (TPC)		mg Ferulic acid eqs / 100g dry weight basis	229	337	330	195	196	290
			38.4	114	137	10.0	9.34	88.0

Results showed a good correlation between the two methods for analysing TAA: FRAP and DPPH ($r^2=0.96$). Antioxidant activity was highest in the bran fractions and lowest in the flours. The same pattern of results was seen for the TPC, which were significantly positively correlated with antioxidant activities (FRAP, $R^2=0.97$ and DPPH, $R^2=0.9$). This confirms that the phenolics present in the grain are responsible for the antioxidant activity (Baublis *et al.* 2000b). However, the high TPC found in the flour fraction was unexpected and was not seen in the FRAP, perhaps reflecting a limitation in the methodology. Further analysis of commercially available flours yielded similar results. Interestingly, comparison of the two bran fractions (coarse and fine) showed that the fine bran fraction had a higher TAA but a lower TPC than the coarse fraction. Defatting of samples with hexane prior to analysis gave values for FRAP, TPC and DPPH which averaged 93.9%, 98.3% and 108.4% of undefatted values corrected to a fat-free basis. This indicates that the antioxidant activities observed cannot be attributed to fat-soluble components. Comparison of whole-grain values obtained by direct analysis, or by calculation from the fraction values, showed recoveries of 96% (FRAP), 100% (TPC) and 132% (DPPH).

These results (also verified in a second cultivar) not only confirm that the antioxidant activity of wheat is concentrated in the bran fractions, but also suggest that there may be variation between bran fractions.

Baublis A, Decker EA & Clydesdale FM (2000a) *Food Chemistry* 68, 1–6.
Baublis A, Clydesdale FM & Decker EA (2000b) *Cereal Foods World* 45, 71–74.
Benzie JF & Strain JJ (1996) *Analytical Biochemistry* 239, 70–76.
Food and Drugs Association (1999) *Food Chemical News* 19, 13–14.
Miller HE, Rigelsdorf F, Marquant L, Prakash A & Kanter M (2000) *Cereal Foods World* 45, 59–63.
Singleton VL & Rossi JA (1965) *American Journal of Enology and Viticulture* 16, 144–148.

Evaluation of the *in vitro* antioxidant activity of oat products as influenced by source and milling conditions. By A.M. LEE, R.W. WELCH, R.K. BEATTIE and J.I. STRAIN, *Northern Ireland Centre for Diet and Health, School of Biomedical Sciences, University of Ulster, Coleraine, BT52 1SA*

Evidence suggests that increased intake of whole-grain foods decreases the risk of cancer and certain age-related diseases (Miller *et al.* 2000). One hypothesis to explain the beneficial effects suggests that the phytochemicals, such as phenolics, present in whole grains, exhibit antioxidant activity *in vivo* (Miller *et al.* 2000) and may therefore protect against oxidative damage, and hence reduce the risk of certain diseases. Oat is a nutritious whole-grain cereal containing phenolics, including ferulic acid, caffeic acid, and avenanthramides, which have demonstrated antioxidant activity *in vitro* (Dimberg *et al.* 1993). The aims of the present investigation were to evaluate the *in vitro* antioxidant effects of oats as influenced by source and milling conditions, to investigate the effects of processing on these effects and also to investigate the relationship between antioxidant activity and total phenolics.

Samples were obtained during different stages of the dry milling process from a commercial oat-miller, on two occasions. They included hand dehulled input grain, dehulling waste (rich in trichomes), oat groats before and after heat stabilization, and jumbo oat flakes, the final product of the milling process. Further retail oatmeal, oat-bran and toasted oat products were obtained from suppliers in Ireland, the UK and Sweden. 50% methanolic extracts of each of the samples were analysed for total antioxidant activity (TAA) using the ferric reducing antioxidant potential (FRAP) assay (Benzie & Strain, 1996), and the DPPH method (Singleton *et al.* 2000). Total phenolic content (TPC) was determined using Folin & Ciocalteu's phenol reagent (Singleton & Rossi, 1965). FRAP and TPC results were expressed as milligrams of ferulic acid equivalents (FAE) on a dry weight basis.

	FRAP (mg FAE/100g)	DPPH (mmol/100g)	TPC (mg FAE/100g)
Milling samples (n=5)*	58-170	2.59-7.49	73-280
Retail oatmeal (n=6)*	52-94	2.72-3.12	73-125
Toasted oats (n=3)*	72-90	3.05-4.18	80-100
Retail oat bran (n=5)*	64-130	2.28-3.37	87-144

* Ranges obtained for each set of samples.

The fine waste from dehulling gave the highest TPC and highest TAA of all samples tested. Results indicated that heat stabilization of the oats gave a moderate decrease in TAA and TPC. Analysis of the retail oatmeal samples showed considerable variation. FRAP and TPC were highest in the Swedish samples whereas the Irish sample gave a high DPPH result and a relatively low FRAP result. The results for the bran samples were also variable, although overall they displayed higher TAA and TPC than the oatmeal or milling samples analysed. Although TPC and FRAP values of the toasted oat products were not notably different from other samples analysed, DPPH values were the highest recorded. The reasons for this, however, are not clear.

On the basis of the data, it is clear that there is substantial variation in antioxidant activity and phenolic content of the retail products analysed. This result was unexpected and may be due to variations in parent groats, milling conditions or bran extraction rates. The data also suggest that phenolics are concentrated in the bran layer of the whole grain, and that these may consequently contribute to total antioxidant activity. Therefore, on the basis of the results obtained, it is clear that processing of the whole grain to concentrate the bran layer should increase the antioxidant activity of the final product.

Benzie IF & Strain JI (1996) *Analytical Biochemistry* **239**, 70-76.
 Dimberg LH, Theander O & Lingnerth H (1993) *Cereal Chemistry* **70**, 637.
 Miller HE, Rigelhof F, Marquart L, Prakash A & Kanter M (2000) *Cereal Foods World* **45**, 59-63.
 Singleton VL & Rossi JA (1965) *American Journal of Enology and Viticulture* **16**, 144-148.

Folate analysis of composite meals. By K. PENTIEVA¹, J.A. KIDD¹, D.I. McKILLOP¹, J.I. STRAIN¹, J.M. SCOTT² and H. McNULTY¹, *University of Ulster, Coleraine BT52 1SA and ²Trinity College, Dublin 2, Ireland*

Maintaining an optimal folate status has become increasingly important in light of the emerging role of the vitamin in the prevention of a number of diseases. Efforts have been taken to increase folate intake on a population basis. However, setting appropriate recommendations for folate depends on an accurate estimation of current intakes, which in turn are dependent on folate values published in Food Tables. Recent studies suggest that such values produced by traditional methodology for folate analysis may be underestimates of folate content, mainly as a result of incomplete extraction of folate prior to determination (DeSouza & Eitenmiller, 1990; Tamura *et al.*, 1997; Pfeiffer *et al.*, 1997). Most of these studies have focussed on single foods; therefore, they do not allow the extent of underestimation of current folate intakes based on a mixed diet to be assessed. The aim of this study was to compare the folate content of folate rich composite meals using tri-enzyme treatment with α -amylase, protease and conjugase before folate determination, with folate values derived from the Food Tables.

Six composite meals were designed each to provide 200 μ g folate based on the Food Tables (Paul & Southgate, 1991) and standard portion sizes (Crowly, 1988). Folate content in the composites was measured by *L. casei* microbial assay after thermal extraction and tri-enzyme treatment with α -amylase, protease and conjugase. Ches/Hepes buffer, pH 7.85, containing ascorbate and mercaptoethanol was used during the assay procedure.

Meal	Estimated ^a	Analysed Folate Content (μ g/meal)			
		Conjugase treatment ^b		Tri-enzyme treatment ^b	
		Mean	SD	Mean	SD
Beef Curry	200	594	66	1220	197***
Enchilada	200	447	50	750	177***
Roast Chicken	200	395	61	885	151***
Fried Calf Liver	200	740	161	1120	220***
Cold Meat Salad	200	816	71	956	146*
Filled Baked Potato	200	257	53	617	79***

^aEstimated according to Paul & Southgate (1991). ^bValues are means $\pm$ SD, based on three independent experiments. Significantly different from folate values after conjugase treatment by t-test (*P<0.05; ***P<0.0001).

Results showed that mean folate content of the meals after conjugase treatment alone was 541 $\pm$ 213.9 μ g/meal (2.7 times higher than the calculated one). Tri-enzyme treatment increased further folate yield to 924 $\pm$ 225 μ g/meal (4.6 times higher than the estimated folate values). No significant relationship was identified between the increase of measurable folate in composite meals after tri-enzyme treatment and the relative macronutrient content of these six meals. The most likely explanation for the marked difference between folate values generated from Food Tables and analytically produced could be the complete liberation of folate from food matrix by using tri-enzyme extraction procedure.

This study demonstrates that for the accurate measurement of folate content in foods, it is essential to apply tri-enzyme extraction procedures and antioxidants that ensure maximum protection of labile folates. It suggests that the average daily intake of folate may be much higher than is generally considered and confirms the necessity of revising folate values in the Food Tables for more accurate determination of folate intakes and, therefore, recommendations.

Crowly H (1988) *Food Portion Sizes*. London: The Stationary Office.
 De Souza S & Eitenmiller R (1990) *Journal of Micronutrient Analysis* **7**, 37-57.
 Paul AA & Southgate DAT (1991) *McCance and Widdowson's The composition of foods*, 5th edn. London: HMSO.
 Pfeiffer CM, Rogers LM, Gregory JF (1997) *Journal of Agriculture and Food Chemistry* **45**, 407-413.
 Tamura T, Mizuno Y, Johnson KE & Jacob RA (1997) *Journal of Agriculture and Food Chemistry* **45**, 135-139.

Plasma homocysteine is a reliable functional indicator of folate status. By M. WARD¹, J.J. STRAIN¹, J. MCPARTLIN², J.M. SCOTT³ and H. MCNULTY¹. ¹Northern Ireland Centre for Diet and Health, University of Ulster, Coleraine, BT52 1SA and ²Departments of Clinical Medicine and ³Biochemistry, Trinity College Dublin, Republic of Ireland

Establishing a reliable functional indicator of folate status has become an urgent priority because of the increasing recognition of the role of the vitamin in the prevention of disease. Plasma homocysteine is folate status dependent and folate is, recognised as the major determinant of total plasma homocysteine (tHcy) concentration. Numerous studies have demonstrated a homocysteine-lowering effect of folic acid (FA) at doses ranging from 0.2 to 5 mg/d, with evidence to suggest that optimal lowering may be within the physiological range (Ward *et al.* 1997). To examine the reliability of plasma homocysteine as a functional marker of folate status, we examined the dose-response relationship of tHcy to increasing physiological doses of folic acid. Forty-four healthy males aged 18–45 years were screened to identify twenty with tHcy levels in the range shown previously to respond to lowering by FA (Ward *et al.* 1997) and excluding homozygotes for thermolabile methylenetetrahydrofolate reductase. Selected subjects proceeded to intervention with FA administered daily at a starting dose of 0.1 mg $\times$ 6 weeks, increasing to 0.15 mg $\times$ 6 weeks, followed by 0.2 mg $\times$ 6 weeks and finally 0.4 mg $\times$ 14 weeks. Subjects were followed for an additional 14 weeks after completion of the intervention period (washout). Double-fasting blood samples collected at baseline, following each intervention period and at washout, i.e. 14 weeks post-intervention were analysed for tHcy by radioimmunoassay (Leino, 1999) and serum folate (SF) by microbiological assay (Molloy & Scott, 1997).

	Week 0 Baseline	Week 6 0.1 mg/d	Week 12 0.15 mg/d	Week 18 0.2 mg/d	Week 32 0.4 mg/d	Week 46 Washout	P
tHcy (μ mol/l)	12.1 ^a (3.7)	11.9 ^a (2.1)	11.1 ^{a,c} (2.6)	10.6 ^{a,c} (1.6)	9.7 ^b (4.3)	11.4 ^{a,c} (2.9)	<0.001
SF (μ g/l)	4.5 ^a (2.9)	6.2 ^{a,c} (2.9)	6.7 ^a (4.1)	10.2 ^b (6.3)	22.1 ^c (11.3)	8.4 ^{a,c} (6.6)	<0.001

Values are median (inter-quartile range) and represent the mean of two fasting samples collected 4–7 d apart. Analysis was carried out on transformed data. Values with different superscripts are significantly different (repeated measures ANOVA; $P < 0.05$; *post hoc* Bonferroni).

A total of fifteen subjects completed the study. Intervention with 0.1 mg FA did not result in any significant change in SF or tHcy concentration compared to baseline. A small significant increase in SF was observed in response to 0.15 mg FA; however, the corresponding decrease in tHcy was non-significant. Increasing the dose of FA to 0.2 mg/d resulted in a significant increase in SF concentration compared with both baseline and the response to 0.1 mg/d FA and a corresponding significant decrease in tHcy concentration. Supplementation with the highest dose of folic acid (0.4 mg/d) resulted in a further marked significant increase in SF concentration. However, this did not result in any additional significant lowering of tHcy, compared with the previous dose of 0.2 mg/d. By 14 weeks post-intervention (washout), SF concentration had decreased by 62% compared with the response to 0.4 mg/d FA, which in turn was reflected in a significant increase in tHcy, representing a return to baseline concentration. These results demonstrate that tHcy concentration, which reflects metabolic utilization of folate, responds in a dose-dependent manner to physiological doses of FA, confirming it to be a valid functional indicator of folate status.

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Leino A (1999) *Clinical Chemistry* **45**, 569–571.

Molloy AM & Scott JM (1997) *Methods in Enzymology* **281**, 43–53.

Ward M, McNulty H, McPartlin J, Strain JJ, Weir DG & Scott JM (1997) *Quarterly Journal of Medicine* **90**, 519–524.

Homocysteine in renal transplant patients is affected by immunosuppressive regimens. By J.A. TROUGHTON¹, R. CUNNINGHAM^{1,2}, J.V. WOODSIDE¹, A.P. MAXWELL² and I.S. YOUNG¹. ¹School of Clinical Medicine, Queen's University Belfast, Belfast BT12 6BJ and ²Department of Nephrology, Belfast City Hospital, Belfast BT9 7AB

Increased plasma homocysteine (tHcy) is an independent risk factor for cardiovascular disease. In addition, tHcy has also been shown to be elevated in renal transplant recipients (Wilcken *et al.* 1981; Massy *et al.* 1994; Amadori *et al.* 1996). The aim of this study was to examine the effect of immunosuppressive regimens on tHcy concentrations in renal transplant patients.

Fasting blood was collected from 249 renal transplant recipients (male n 152; female n 97, mean (SD) age 48.2 (14.2) years; creatinine 147 (69) μ mol/l; time since transplant 9.9 (6.9) years). Males and females were similar in terms of age and years since transplant. However creatinine and tHcy were significantly lower in females than males (creatinine: females n 97, 120.1 (1.5), males n 151, 146.7 (1.5), $P < 0.001$; tHcy: females n 97, 14.5 (1.6), males n 152, 16.6 (1.6), $P = 0.028$, mean (SD) μ mol/l). Treatment with cyclosporine was associated with higher tHcy concentrations, whereas treatment with azathioprine was associated with lower tHcy levels. Patients treated with a combination of cyclosporine and prednisolone but not azathioprine had significantly higher tHcy levels than patients treated with a combination of azathioprine and prednisolone but not cyclosporine, as shown in the table below.

Treatment	n	Mean tHcy (μ mol/l)	SD	P-value
Cyclosporine	135	17.2	1.6	0.002
No Cyclosporine	114	14.2	1.6	
Azathioprine	105	14.1	1.5	0.001
No Azathioprine	144	17.1	1.7	
Cyclosporine + Prednisolone	72	17.7	1.7	0.001
Azathioprine + Prednisolone	82	13.3	1.4	

tHcy was positively associated with creatinine ($r = 0.50$, $P = 0.001$) and proteinuria ($r = 0.35$, $P = 0.001$). tHcy was higher in smokers (n 38, 22.1 (1.7)) than in non-smokers (n 205 14.7 (1.6), mean (SD) μ mol/l, $P = 0.001$). No significant difference in tHcy concentrations was found between IHD cases (n 38, 16.5 (1.5)) and controls (n 209, 15.5 (1.6), mean (SD) μ mol/l, $P = 0.49$).

This study shows that immunosuppressive regimens may have diverse effects on tHcy concentrations in renal transplant patients. Further investigation is required on the effect of combination immunosuppressive therapy after controlling for renal function.

Amadori M, Hulberg B, Vladov V, Nilsson-Ehle P & Thysell H (1996) *Transplantation* **61**, 509–512.
Massy ZA, Chadeaux-Vekemans B, Chevalier A, Bader CA, Druke TB, Legendre C, Lacour B, Kamoun P & Kreis H (1994) *Nephrology, Dialysis and Transplantation* **9**, 1103–1108.
Wilcken DEL, Gupta VI & Betts AK (1981) *Clinical Science* **61**, 743–749.

An audit of patients leaving an oncology hospital on home enteral feeding. By L. MAXWELL^{1,2}, N. O'SULLIVAN³, and E.P. MCNAMARA³. ¹University of Dublin, Trinity College, Dublin 2, Republic of Ireland, ²Dublin Institute of Technology, Kevin Street, Dublin 8, Republic of Ireland and ³Department of Nutrition and Dietetics, St. Luke's Hospital, Rathgar, Dublin 6, Republic of Ireland

Over 17% of patients on enteral tube feeding in the community in the UK have a diagnosis of cancer (BANS, 2000). Few studies describe the long-term follow-up of patients on enteral feeding. One US study of cancer patients on enteral tube feeding showed that the mean survival time of cancer patients is 6 months after starting home parenteral and enteral nutrition, but 25% live beyond a year and 20% resume full oral nutrition (Howard, 1993).

The purpose of this audit was to analyse data on tube-fed patients discharged from St. Luke's Hospital, Rathgar (a specialist radiotherapy oncology centre) between January 1999 and December 2000. Patients discharged on enteral tube feeding were identified from records held in the Department of Nutrition and Dietetics. Further information was elicited from medical charts. Public Health Nurses General Practitioners, and other Departments of Clinical Nutrition were contacted to obtain further details on patients' progress outside the hospital setting. Seventy-six patients were identified (sixty-one male and fifteen female). Average age of patients was 62 years (SD 13 years). Diagnoses included cancer of the oral cavity (28%), the oropharynx (17%), the hypopharynx (12%), the larynx (25%) and the oesophagus (6%). Percutaneous endoscopic and radiologically placed gastrostomy feeding was the preferred route of feeding, with only three patients fed via percutaneous endoscopic jejunostomy.

Of the patients, 30% had tubes inserted prior to radiotherapy treatment (an average of 18 d after starting radiotherapy), the remainder had tubes inserted during treatment. Weight prior to, and after, tube insertion was available for seventy-four patients: 79% had lost weight before tube insertion, 18% remained stable and 3% had gained weight. Mean value of weight loss was 8.7 kg (SD 5.5 kg), or 9% of usual weight. One patient had lost 25 kg prior to tube insertion. At the time of audit, outcome was known for seventy patients: 49% had died, 34% had returned to full diet and 17% of patients remained on tube feeding. Of those who died, 3.2% had died by 30 d, 29% had died at 90 d, and 90% were dead by 1 year. Follow-up from a dietitian was reported in only forty-eight cases (63%). Patients who died were more likely to have been discharged on full (as opposed to supplementary) feeding, were less likely to have received follow-up and were more likely to have had their tube placed during treatment ($P < 0.05$). Those patients who returned to oral feeding spent 209 d (SD 163 d) on the tube feed. Patients' weights when tubes were inserted were compared to weights when they died (eight weights out of thirty-four available), returned to oral diet (nineteen weights out of twenty-four available) or continued on tube feeding (six weights out of twelve available).



Patients who lived longer were more likely to be male, under 66 years of age, and have a diagnosis of cancer of the larynx – they were also more likely to be at the higher range of normal BMI and have less than 11% weight loss when the tube was inserted.

Audits of this type should be encouraged in Irish hospitals, as no national register of patients on long-term tube feeding exists. This could be valuable in highlighting deficits (such as poor follow up post discharge and timing of gastrostomy insertion) in practice and ultimately in improving patient care.

British Artificial Nutrition Survey (2000) *BANS Executive Summary 1996–2000*. www.bapen.org.uk accessed 16 April 2002.
Howard L (1993) *Cancer* **72**, 3531–3541.

Setting up a cardiovascular, dietetic clinic service in primary care. By: V. O' CONNOR and M. O' DONNELL. *Community Nutrition and Dietetic Service, Western Health Board, West City Centre, Seamus Quirk Road, Galway, Ireland.*

Cardiovascular disease including heart disease, stroke and related diseases is the single largest cause of death in Ireland, representing 43% of all deaths in 1997 (Department of Health and Children, 1999). The Cardiovascular Strategy – Building Healthier Hearts recommended that Community Dietitians be appointed to work with clients with CHD, stroke, hypertension, other atherosclerotic conditions, diabetes mellitus and obesity (Department of Health and Children, 1999). Primary Health Care is defined as the first level of contact of individuals, the family and the community with the national health system, bringing health care as close as possible to where people live and work and constitutes the first element of a continuing health care process (WHO, 1978). The Western Health Board, Primary Health Care Strategy 2000–2005 focuses on four underlying principles: Focus on good health, Partnership, Quality & Equity (Western Health Board, 2000).

In 2002 the Health Board appointed a Senior Community Dietitian, to develop a primary care dietetic service for cardiovascular clients in Co. Galway.

The overall aim of the service is to improve the nutrition status of the target population (NNSC, 1999), in line with the relevant national cardiovascular disease targets (Department of Health and Children, 1999) and dietary guidelines (Department of Health and Children, 1995).

Key objectives identified were: (1) to expand, develop, implement and evaluate a clinic based nutrition programme in the primary care setting in Co. Galway and (2) to compile, develop and evaluate new resources to support and meet the needs of the target audience.

The initial focus was to carry out a needs assessment of primary care. The needs assessment was carried out from June 2001 – September 2001. This was completed via: (1). Meeting with GPs, Public Health Nurses, Practice Nurses and other Health Professionals, (2). Information on general medical scheme and population numbers for Co. Galway. Clinic locations were chosen on the basis of district electoral division population numbers, number of general practitioners in the practice, general medical scheme numbers, and room availability. Referrals are accepted from GPs, Practice Nurses and Public Health Nurses. A referral pad was developed and piloted. A Policies and Procedure Guideline document was compiled. Updating of resources is ongoing and a food plan is being developed and will be personalised for all clients. An initial Clients satisfaction survey was completed. A postal questionnaire was sent to 600 clients in the Western Health Board. Results are forthcoming. In all areas there is ongoing process evaluation.

From the needs assessment it was identified that 100% (n 169) of those surveyed wanted access to the service. 37% of GPs wanted a dietetic clinic in their own practice. Other identified needs included the following: (1). Shorter waiting times to see the dietitian, (2). A more local service, (3). Access to nutrition resources in English and Irish, (4). Dietetic consultations in Irish, (5). Services for children and (5). Domiciliary visits. Process evaluation identified that on average that 57 referrals were received per month. The majority (93%) were from GPs, with half of those referred being general medical scheme clients. Clients are mostly in the 16 – 64 year old age bracket, with the majority of referrals (43%) being for clients with obesity. Initial results from the client satisfaction survey are very positive. With most clients reporting some positive lifestyle changes. Over half of the clients report weight loss and up to 70% report having made dietary changes.

The needs assessment highlighted the huge interest and the need for an accessible clinic based cardiovascular dietetic service. The process evaluation showed that only 25% of GPs refer patients. A survey of non-users is needed. A second post is required in order to meet service needs and reach the target outlined in the cardiovascular strategy. The long-term goal is to develop a user friendly, equitable, dietetic clinic service for cardiovascular clients in Co. Galway.

Department of Health and Children (1999) *Building Healthier Hearts. The Report of the Cardiovascular Health Group*. Dublin: Stationary Office.
Department of Health and Children (1995). Recommendations for a Food and Nutrition Policy for Ireland. Dublin: Stationary Office.
National Nutrition Surveillance Centre (1999) *Dietary Habits of the Irish Population: Results from SLAN*. Galway.
Western Health Board (2000) *Tus Maithe. A strategy for Primary Care in the Western Health Board*. Western Health Board.
World Health Organisation (1978) *Report of the International Conference on Primary Health Care*. Geneva:WHO.

Setting up a peer-led nutrition project for disadvantaged groups in Galway City. By M. HURLEY and M. O'DONNELL, *Community Nutrition and Dietetic Service, Western Health Board, West City Centre, Seamus Quirke Road, Galway, Republic of Ireland*

Results from the SLAN survey (NNSC, 1999) show unacceptable socio-economic variations in the population, in that the less affluent report a less healthy diet overall. To improve the nutritional status of this population, a senior Community Dietitian was appointed by the Western Health Board in 2000, to develop a nutrition programme for disadvantaged groups in Galway City. The Community Dietitian is linked to five projects comprising three neighbourhood youth projects and two family support services. These projects are based in three designated disadvantaged areas of Galway City (Western Health Board, 2001).

In 2001, a needs assessment was carried out in these three locations. Results indicated a need for a project to address nutrition issues amongst socially disadvantaged groups. In order to address this need the "Healthy Food Made Easy" pack, developed by the Department of Health and Children (1999) was selected for implementation in these communities. This community peer-led nutrition intervention project involves training participants to teach a healthy eating course to groups in their local communities. It is aimed at supporting people who are interested in healthier eating, particularly where cost is a consideration. The main goal is to help improve people's access to good quality information that can be put into practice in the everyday life.

The planning phase of the project commenced in January 2001. Objectives were to train participants to give food and nutrition courses in their local areas; to improve the nutritional knowledge of the participants; and to improve the nutritional status of people living in Galway City.

A pilot project was set up thereafter to ascertain the usefulness of the *Healthy Food Made Easy* pack. Five staff from family support services and neighbourhood youth projects were recruited, and trained in nutrition using the pack. Results of the evaluation of the pilot were very positive. After completion of the programme, 100% of participants indicated that they were more conscious of the nutritional value of foods when out shopping, and 80% had changed their eating habits as a result. As well as the programme being a useful way of imparting information effectively, the Community Dietitian also found the manual to be user-friendly, easy to follow and overall a very useful teaching tool.

The next phase of the project was the recruitment of suitable trainers. Five women were recruited from the three designated disadvantaged areas of Galway City and training commenced in October 2001. A training programme of eighteen sessions, consisting of twelve sessions on nutrition and six on facilitation skills, was set up. One session was held per week over the course of 18 weeks, spanning from October 2001 to April 2002. Training is now complete and results of an evaluation of this phase of the project are as follows: 100% of participants changed from full fat products to low fat products, 80% increased their fruit and vegetable intake and 100% of participants changed to healthier cooking methods.

The next phase of the *Healthy Food Made Easy* project is the implementation in the community. The five qualified trainers will now be employed to teach healthy eating courses to groups in disadvantaged areas of Galway City. The Community Dietitian will remain as co-ordinator of the project and will act as a support for the trainers. Nutrition update sessions will take place on a monthly basis to ensure that the trainers are familiar with any new developments in the field of nutrition. Evaluation of this phase will be ongoing.

The implementation of a peer-led nutrition project such as *Healthy Food Made Easy* is a positive step in addressing nutrition issues among disadvantaged groups in Galway City. Peer-led projects also have the added benefit of empowering the participants by encouraging them to take more control over their own decisions, in this case decisions regarding their health. The long-term goal is to extend the programme to other disadvantaged areas within the Western Health Board, pending a positive outcome of the evaluation.

Department of Health and Children (1999) *Healthy Food Made Easy*. Dublin: Stationery Office.
National Nutrition Surveillance Centre (1999) *Dietary Habits of the Irish Population: Results from SLAN*. Galway: NNSC.
Western Health Board (2001) *Child and Family Care Services: Five Year Strategy*. Galway: Western Health Board.

Healthy eating policy development in primary schools – the learning process. By L. KIRBY and M. O'DONNELL, *Community Nutrition and Dietetic Service, Western Health Board, West City Centre, Seamus Quirke Road, Galway, Republic of Ireland*

It is well established that good nutrition is one of the key factors in influencing health. Promoting healthy eating at a young age will not only contribute to better mental, social and physical health during this stage of life, but also sets the foundation for good health in adulthood. A report on recommendations for food and nutrition policy for Ireland (Nutrition Advisory Group, 1995) suggests that healthy eating should be promoted in schools through school policy, the curriculum and the provision of healthy food choices in canteens and tuck-shops. The Cardiovascular Health Strategy (Department of Health and Children, 1999) identifies schools as an important health promotion setting and recommends that all aspects of health promotion be considered within the school curriculum.

The aim of the Community Dietitian is to improve the health of the population of young people in the Western Health Board in line with the recommendations of the Cardiovascular Health Strategy. The main objective of this project is to support schools in the development of healthy eating policy. A needs assessment of all primary schools in the Western Health Board region ($n = 475$) was completed. This addressed the following: (1) the presence if any, of healthy eating policy in schools; (2) the presence of health-promoting programmes within the school curriculum; (3) the use of healthy eating leaflets/packs in schools; (4) the presence of canteens and tuck-shops in primary schools; (5) the school's interest in developing healthy eating policy.

There was a 55% response rate, with a total of 68.3% of primary schools indicating that they would like some assistance in developing a healthy eating policy. From those that requested assistance and included Social, Personal and Health Education on the curriculum and were willing to adopt the whole school approach, eight were randomly selected. The main objectives of the Community Dietitian were to support and encourage these schools through the process, to identify the different approaches used by the schools involved and to gain an understanding of the opportunities and challenges faced by schools.

A number of standard protocols were expected of the pilot schools. A whole school approach to healthy eating was taken. A working committee for each school was set up to develop the policy. This committee included representatives of parents, teachers, pupils and any other group that might be affected in any way by a healthy eating policy. Any healthy eating initiatives were promoted within the context of the taught curriculum, in particular Social, Personal and Health Education. Schools were encouraged to take ownership of the healthy eating policy, recognizing that it was unique to the needs of their school. The project is continuing, the schools must now develop a written policy, the content of which will be made known to all relevant parties. Each school is completing different activities and events to promote the healthy eating policy and communicate the message to all. The project will come to a conclusion at the end of this academic year. The schools will revise their healthy eating policy each year. An example of a healthy eating policy would be to include a piece of fruit in the lunch box or to confine crisps and chocolate to one day a week. Also teachers were encouraged to include some classroom activity which promotes healthy eating.

The role of the Community Dietitian was primarily a consultative one, to guide and support the committee during the process. The Community Dietitian also supported different initiatives within the school and provided education seminars to parents, teachers or students as requested. This process of promoting healthy eating is valuable on many levels. It empowers children to make healthy choices. It encourages parents to get involved in school initiatives, and it ensures that consistent messages are being communicated in the classroom, the whole school and in the home. The presence of school policy supports teachers in promoting healthy practices. The process also allows the Community Dietitian to be involved in a supporting role, which ensures that the school, with the support of parents, takes on the responsibility of healthy eating. This is a much more sustainable role than simply imparting information on nutrition without the presence of a school policy.

After completion of the pilot project, and using the information gained from the experiences of the eight pilot schools, the Community Dietitian will continue to support schools in the development of healthy eating policy in the future. The school as a health promotion setting will continue to play a valuable role in promoting health to young people.

Department of Health and Children (1999) *Building Healthier Harbours: A Report of the Cardiovascular Health Strategy Group*. Dublin: Stationery Office.
Nutrition Advisory Group (1995) *Recommendations for a Food and Nutrition Policy for Ireland*. Dublin: Stationery Office.

Dietary energy and macronutrient intake among Bangladeshis in East London. By J.W. RAHMAN and V. COSTARELLI, *School of Applied Science, South Bank University, 103 Borough Road, London SE1 0AA*

In South Asians (Indians, Pakistanis and Bangladeshis) settled overseas, high rates of coronary disease and non-insulin-dependent diabetes occur in association with central obesity and insulin resistance (Donahue *et al.* 1987). It has also been shown that dietary total fat intake and the polyunsaturated/saturated ratio was higher among Bangladeshi men than other South Asians and that they had the highest concentration of triacylglycerols and high-density lipoprotein cholesterol (Bhopal *et al.* 1999). The purpose of the current study was to estimate the dietary energy and macronutrient intakes of a small sample of Bangladeshi adults in East London. Thirty-two Bangladeshis, fifteen males (mean age 50 years, SD 5.6), mean BMI 29.5 kg/m² (SD 2.1), mean weight 79.5 (SD 5.7) and seventeen females (mean age 40 years SD 4.5), mean BMI 28.6 kg/m² (SD 2.5) and mean weight 69.4 (SD 4.1) were recruited from the London Borough of Tower Hamlets. Dietary information was obtained using a single 24-h recall and analysed using the Diet 5 program (Robert Gordon University, Aberdeen). The 24-hour recall method has many limitations, however, a trained dietician conducted the study, the subjects were visited at home and all interviews were conducted in Bengali, to ensure more accurate results. Energy expenditure was also assessed using a physical activity diary for a week. The data are summarized in the Table.

	Dietary intake of subjects determined by 24-h recall							
	All subjects (n 32)		Males (n 17)		Females (n 15)		EAR (MJ/d)	
	Mean	SE	Mean	SE	Mean	SE	Males	Females
Energy (MJ/d)	13.14	1.6	14.52***	2.4	12.79***	2.3	10.66	8.11
Protein (% energy)	15.84	2.02	14.8	0.3	17.01	0.3		
Carbohydrate (% energy)	48.09	2.01	46.9	5.1	49.4	6.2		
Fat (% energy)	35.90	0.4	38.1	3.6	33.4	3.3		
SFA (% energy)	15.66	2.04	16.47	0.9	14.75	0.5		
PUFA (% energy)	7.77	3.03	6.54	1.7	9.16	1.05		
MUFA (% energy)	12.10	2.4	11.58	0.9	12.66	0.4		

***P<0.001; one-sample Student's *t*-test.

The results show a very high daily intake of energy, particularly in females in comparison with the current recommendations (Department of Health, 1992). All the subjects, who were selected randomly, were also overweight and had very sedentary lifestyles. Given the very high risk of the above group for the development of non-insulin-dependent diabetes, coronary heart disease and central obesity, it is clear that major changes need to be made to the diet in order to improve health. Educating this group on healthy eating is a major task and should become a priority in order to decrease the mortality and morbidity rates from non-insulin-dependent diabetes and coronary heart disease.

Bhopal R, Unwin N, White M, Yallop J, Walker L, Alberti KGM, Harland J, Patel S, Ahmad N, Turner C, Watson B, Kaur D, Kulkarni A, Laker M & Tavridou A (1999) *British Medical Journal* **319**, 215-220.
Department of Health (1992) No.41 *Dietary Reference Values for Food Energy and Nutrients for the UK*. London: HMSO.
Donahue RP, Abbott RD, Bloom E, Reed DM & Yano K (1987) *Lancet* **1**, 821-824.

The Happy Heart Catering Award 1998-2001. By A. O'SHEA, O. CAROLAN and N. ELGIN, *North Eastern Health Board (NEHB), Health Promotion Department, Railway St., Navan, Co. Meath, Republic of Ireland*

Heart Disease remains a major cause of death in Ireland. In the North Eastern Health Board (NEHB) region 44.7% of all deaths can be apportioned to circulatory diseases. The award is an innovative and collaborative initiative, which was developed in partnership with the Health Promotion Unit of the Department of Health and Children, the Irish Heart Foundation and the Health Promotion Unit of the NEHB. The North/South Ireland Food Consumption Survey 2001 reported that, overall, one-third of all energy is consumed outside the home. Hence the need exists to establish practical nutritional guidelines and to implement current legislation on food safety and smoking restrictions. The Happy Heart Catering Award aims (1) to offer healthy food choices, especially dishes low in fat, and to increase the consumption of fruit and vegetables, (2) to comply with food safety legislation, and (3) to comply with smoking legislation in public places. Initially an Environmental Health Officer recommends premises that are suitable for the award. If the proprietor agrees, a dietitian visits the premises to assess and make recommendations. Six weeks later, the dietitian returns to audit and assess progress. Once everything complies they are eligible for the award. As food premises are considered high-risk from a food safety point of view, they each receive two audits annually. To date, twenty-six awards have been presented throughout the NEHB region. The initiative is based on best health promotion practice and encompasses partnership in line with all national and international strategies. It utilizes a workplace setting approach. It profiles and highlights the fiscal advantages of the private sector being involved in health promotional activities. This initiative is a model that may be extended and used throughout the country. An evaluation was undertaken by the Department of Public Health Medicine, NEHB, 1 year following the first award ceremony. The findings for the eight restaurants visited are presented below.

Availability of food choices on the menu					
A low fat chicken, fish, or lean red meat dish	8	100%	Mini packs low-fat spread	7	86%
Baked, jacket or mashed potato (no added fat), rice/pasta	8	100%	Black pepper and low salt	5	63%
Two choices vegetables or salad	8	100%	Low-fat salad dressings	5	63%
Wholemeal bread or brown bread rolls	7	86%	Fresh fruit	7	86%
Optional sauces, gravy, dressings on side	8	100%	Artificial sweeteners	8	100%
Fruit salad or low-fat fruit-based dessert	7	86%			
Fruit juice and water	7	86%			

Compliance with the requirements was deemed very good. However, improvement is required in the availability of low-salt alternatives and low-fat spreads. Publicity for restaurants obtaining the award is essential, both to reward the restaurant and to encourage others to participate. Continuity is also essential and the North Eastern Health Board's Community Dietitians and Environmental Health Officers monitor standards strictly throughout the year. The project is intended to make changes in the long term. Evaluation by public health researchers is ongoing and evaluation reports will be available periodically.

