Proceedings of the Nutrition Society

Abstracts of Original Communications

A joint meeting of the Clinical Nutrition and Metabolism Group of the Nutrition Society and the British Association for Parenteral and Enteral Nutrition was held at Bournemouth International Centre on 8–10 December 1998, when the following papers were presented.

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

The Editors of the Proceedings of the Nutrition Society *accept no responsibility for the abstracts of papers read at the Society's meetings for original communications.*

Disease-related malnutrition: existence, causes and consequences, and clinical and financial benefits of nutritional intervention. By CERI J. GREEN, *Numico Research B.V., Bosrandweg 20, 6704 PH Wageningen, The Netherlands*

Disease and malnutrition are intimately related, with one predisposing to the other. Chronic undernutrition, initially uncomplicated by disease, leads to serious deficiencies in work capacity, resistance to infections, ability to heal wounds, organ function, mental state and growth. Conversely, the presence of disease can lead to undernutrition by reducing digestion and absorption of nutrients, by altering the metabolism of nutrients, or most importantly, by reducing food intake because of anorexia, pain and/or weakness making it difficult to shop, cook and eat. Irrespective of the precipitating cause of undernutrition, its consequences will not only have a negative effect on quality of life, but will also affect the incidence of complications and clinical outcome, and thus the costs associated with prolonged treatment and loss of productive capacity in the community.

The occurrence of disease-related malnutrition, its identification, its causes and its consequences are not recent phenomena. Since the early 1970s there have been numerous publications in these areas, particularly in the hospital setting. Hospital stay itself constitutes a risk factor for further deterioration of nutritional status, especially in those who are already malnourished on admission. In 1998, reports of malnutrition in patients in hospitals are still frequent. Furthermore, it is becoming increasingly apparent that many groups with impaired health in the community (at home and in institutional care) are also at risk.

Methods for providing nutritional support, including oral supplements, enteral and parenteral formulations, methods of gut access and the equipment required to administer nutritional support have been developed and refined over recent years. For patients with an inability to eat or failure of the gastrointestinal tract, enteral and parenteral nutrition are life-saving therapies. Patients with shorter-term deficiencies in intake will also benefit from nutritional support. Clinical benefits have even been shown in patients who are only marginally depleted. Malnutrition associated with disease (or even perhaps the inadequate intake associated with disease or its treatment) does contribute to clinical outcome and is not simply a marker of the severity of the underlying disease process. Despite the available techniques and growing knowledge, the continuing reports of disease-related malnutrition demonstrate resoundingly that too few patients are receiving appropriate nutritional support.

Identifying the cost savings associated with improved clinical outcome as a result of administering nutritional support is clearly an area where more prospective research is needed. However, retrospective calculations indicate that use of appropriate nutritional support is associated with savings that are much too large to ignore (Green, 1998).

Although there is still a need to determine a universally accepted definition of disease-related malnutrition for study purposes, sophisticated and expensive techniques are not necessary to determine whether a patient is already malnourished or is at risk of becoming so. Neither the tools for identifying malnutrition nor the methods available for alleviating the problem are the limiting factors. Many of those who would benefit from nutritional support are simply not receiving it. The time has come for a concerted effort to ensure that disease-related malnutrition is no longer allowed to go unnoticed or untreated. This means training of hospital and community staff, a team approach to nutritional care, clear division of responsibilities, and commitment of senior management to ensure that accepted guidelines are followed. In the UK, the British Association for Parenteral and Enteral Nutrition (BAPEN) is a tremendous resource of information and expertise which should be utilized at a national level to ensure that essential changes to the current situation can be made. Similar initiatives in other countries could help to tackle the problem on an international scale.

Green C J (1998) *South African Medical Journal* **88**, 92-98.

Evidence and consequences of disease-related malnutrition in the community. By JACKIE EDINGTON, *Medical Division, Abbott Laboratories, Maidenhead, SL6 4XE*

The continuum of disease-related malnutrition in the UK ranges from a prevalence of about 9 % while patients are being cared for in the community by the primary health care team (Edington *et al.* 1996, 1997), to between 40 and 50 % in people admitted to hospital (McWhirter & Pennington, 1994). People whose nutritional status has been studied in the community and who have been found to be malnourished are post surgical patients (Edington *et al.* 1997) and those with cancer and chronic diseases (Edington *et al.* 1996). On admission to hospital, it is the elderly, medical, surgical and orthopaedic patients and those with respiratory disease who are most likely to be malnourished (McWhirter & Pennington, 1994).

The clinical consequences of malnutrition, whether in the hospital or in the community, are well known. Body composition changes, and this results in reduced immunity, delayed wound healing, endocrine and other physiological changes. The practical consequences of malnutrition in the community, in terms of cost to the National Health Service, were demonstrated in a study published this year. We found that patients with chronic diseases who have either a low or a high BMI use significantly more health care resources in the community than those with a BMI in the normal range. They visit their general practitioner more frequently, receive more prescription drugs and are admitted to hospital more frequently. Furthermore, mortality increases as BMI decreases (Martyn *et al.* 1998).

In a further study, we have analysed the use of health care resources, by BMI, in 4689 patients with coronary heart disease and stroke, and 5628 patients with cancer of the prostate, breast, lung and gastrointestinal tract. Included in the analysis are prescription rates, GP consultation rates, outpatient referrals, hospital admissions and mortality. Data on the use of the same measures of health care resource use by 2668 elderly patients with cardiovascular disease, and 3208 elderly patients with cancer in the community are also being analysed.

We found a distinct, statistically significant U-shaped relationship between prescription rates and general practitioner consultation rates in patients with cancer and cardiovascular disease ($P < 0.001$). In patients with cardiovascular disease with a BMI in the range 15 to < 20 kg/m^2, hospital admission rates were 64 % higher than in those with a BMI in the range 20 to < 25 kg/m^2 ($P < 0.001$) but there was no relationship between BMI and hospital admission rates in patients with cancer. There was no relationship between BMI and outpatient referral rates in either disease state. However, in patients with both cancer and cardiovascular disease, those in the lowest BMI category had significantly higher mortality ratios than in any other BMI category ($P < 0.001$). This was also true when elderly patients were analysed separately.

This study emphasizes the importance of nutritional status in the management of common diseases.

Edington J, Kon P & Martyn CN (1996) *Clinical Nutrition* **15**, 60-63.
Edington J, Kon P & Martyn CN (1997) *Journal of Human Nutrition and Dietetics* **10**, 111-116.
Martyn CN, Winter PD, Coles SJ & Edington J (1998) *Clinical Nutrition* **17** 119-123.
McWhirter JP & Pennington CR (1994) *British Medical Journal* **308**, 945-948.

An evaluation of the use of enteral nutritional supplements post operatively in malnourished surgical patients. By A.H. BEATTIE, J.P. BAXTER, A.T. PRACH and C.R. PENNINGTON, *Department of Digestive Diseases and Clinical Nutrition, Ninewells Teaching Hospital NHS Trust, Dundee DD1 9SY*

The prevalence of malnutrition among hospitalized patients and the relationship of malnutrition to increased morbidity, mortality and length of stay, especially in surgical patients, has been well documented. The aim of the present study was to investigate the effect of supplementing dietary intake in malnourished surgical patients on nutritional status, clinical outcome and quality of life; also to assess the cost implications of supplementing dietary intake in these patients. Eighty-two patients between 18 and 80 years admitted for gastrointestinal and vascular surgery were entered into the study. Entry was determined by the presence of malnutrition defined by BMI <20 Kg/m^2, triceps skinfold thickness (TSF) or mid arm muscle circumference (MAMC) <15 th percentile and/or a weight loss of more than 5 % from the time of assessment on admission to post operative assessment. Patients were randomized to treatment group or control group. On resumption of oral diet, nutritional requirements and oral intake were assessed in the treatment group to allow for prescription of a nutritional supplement (6.3 KJ/ml) to address any nutritional deficit. The control group continued with routine nutritional management. Nutritional status was assessed by weight, BMI, TSF, MAMC and grip strength with measurements taken at 2 weekly intervals post operatively which continued into the community. Clinical outcome was assessed by the documentation of complications for the duration of the study. Quality of life was assessed by the UK SF-36 Questionnaire (Jenkinson *et al*, 1996) completed at initial and final assessment. The changes between questionnaires completed at initial and final assessments were assessed using the Mann Whitney U test. Change in nutritional variables between first post operative assessment and final assessment in the control and treatment groups are given in the Table.

	Control (n 40)		Treatment (n 42)		*Significance of difference, P <* *
	Mean	SD	Mean	SD	
Weight Gain (Kg)	-3.753	4.538	0.140	4.609	*< 0.001*
Increase TSF (mm)	-0.775	1.441	0.275	1.432	*< 0.005*
Increase MAMC (cm)	-0.875	1.324	0.075	1.403	*< 0.001*
Increase Grip (Kg)	-0.800	2.785	0.950	2.995	*< 0.005*

* By the Wilcoxon Rank Sum W Test

It was observed that without dietary intervention patients lost weight for up to eight weeks following discharge into the community. Nutritional supplementation had a significant positive effect on all measured nutritional variables in the intervention group in comparison with the control group. The treatment group showed substantial improvements in both physical (p=0.001) and mental health (p=0.006) compared with the control group which showed only small improvements. Infection rates in the control group (n 10) were higher than the treatment group (n 6) as was antibiotic prescription rate (control n 12, treatment n 7) this did not reach statistical significance. The cost of the supplementation was £3.04 daily (£21.28 weekly).

Post operative nutritional supplementation is a straightforward and inexpensive way to minimize further weight loss, improve nutritional status, improve quality of life and possibly improve clinical outcome in malnourished patients.

Jenkinson C, Layte R, Wright L & Coulter A (1996) The U.K. SF-36 : An Analysis and Interpretation Manual. Health Services Research Unit.

Can the true prevalence of malnutrition be assessed at admission to hospital? By N.C. STRAIN[1], C.E. WRIGHT[1], K. WARD[1] and J.L. SHAFFER[2], [1]*Department of Nutrition and Dietetics, Manchester Royal Infirmary, Manchester M13 9WL,* [2]*The Intestinal Failure Unit, Hope Hospital, Salford M6 8HD*

The prevalence of malnutrition in UK hospitals has been predicted to be 40 % using BMI, anthropometry and percentage weight loss (%WL) (McWhirter & Pennington, 1994). The British Association of Parenteral and Enteral Nutrition (BAPEN) have recommended that nutritional screening should include measurement of height and weight and questioning regarding any recent changes in weight and appetite (Lennard-Jones *et al.* 1995). The present study aimed to examine the prevalence of malnutrition in an English teaching hospital and to assess the feasibility of BAPEN nutritional screening recommendations.

This was a prospective study involving 192 randomly selected medical and 208 randomly selected surgical patients, (including fifty-five orthopaedic and twenty-seven maxillo-facial surgery) (age range 16-95 years, median age 68 years) expected to be in hospital for ≥1 week. Patients admitted for shorter periods were not assessed to exclude those admitted for minor procedures. Anthropometry including measurement of height and/or demispan, weight, mid-arm circumference (MAC) and triceps skinfold (TSF) was performed on admission. Usual weight was noted and BMI, %WL and mid-arm muscle circumference (MAMC) were calculated. Where possible before discharge patients were reweighed.

Adequate nutritional assessment could not be performed in 18.5 % of patients using McWhirter & Pennington (1994) criteria and 27.5 % of patients using BAPEN recommendations due to the patient's inability to cooperate with measurements. Oedema and/or ascites were present in a further thirty-six (9.1 %) of the patients studied and were not corrected for when calculating BMI and/or %WL.

Degree of malnutrition	Medical (n 156)	Surgical (n 170)	Total (n 326)
Overweight (BMI >25 + TSF/MAMC >10th centile + 0-9 %WL)	51 (32.7%)	91 (53.5%)	142 (43.6%)
Normal (BMI 20-25 +TSF/MAMC >10th centile + 0-9 %WL)	56 (35.9%)	50 (29.4%)	106 (32.5%)
Mild (BMI 18-20 + TSF/MAMC <10th centile +/or 0-9%WL)	5 (3.2%)	8 (4.7%)	13 (4.0%)
Moderate (BMI 16-18 + TSF/MAMC <5th centile +/or 10-15 %WL)	25 (16.0%)	15 (8.8%)	40 (12.3%)
Severe (BMI <16 + TSF/MAMC <5th centile +/or >15 %WL)	19 (12.2%)	6 (3.5%)	25 (7.7%)

For logistical reasons, only ninety-five (29 %) patients were reweighed on discharge. These patients were not pre-selected. Weight loss occurred in sixty-five (68.4 %) patients, weight gain in twenty-two (23.2 %), while in eight (8.4 %) weight remained stable. This concurs with earlier work (McWhirter & Pennington, 1994), showing that the majority of patients lose weight while in hospital.

Nutritional assessment could not be performed in between 18.5 and 27.5 % of patients depending on the assessment criteria used. The prevalence of malnutrition in patients who could be assessed on admission to hospital was 24 % using McWhirter & Pennington (1994) criteria (see Table) and 30 % using BAPEN recommendations. Obesity appears to be a greater problem, particularly in surgical patients. It may be that sicker patients at greater risk of malnutrition were excluded in the present study because they were too ill to assess; moreover, oedema may have masked nutritional depletion in a small percentage. The results of the present study indicate that further guidance on nutritional screening in patients too ill to co-operate with assessment or who have oedema is required.

Lennard-Jones JE, Arrowsmith H, Davison C, Denham AF & Micklewright A (1995) *Clinical Nutrition* **14,** 336-340.
McWhirter JP & Pennington C (1994) *British Medical Journal* **308,** 945-948.

A double-blind, controlled trial of glutamine supplementation in parenteral nutrition. By C.P. JAMIESON, D. MURPHY, C. ARCHER, H.V. FAWCETT, O.A. OBEID and J. POWELL-TUCK, *Department of Human Nutrition, St. Bartholomew's and the Royal London School of Medicine and Dentistry, London E1 2AD*

The amino acid glutamine (gln) is readily synthesized by the body tissues, but free plasma gln levels are diminished in metabolic stress. Standard parenteral feeding regimens do not supply gln because of problems of problems of stability and solubility, but in recent years, gln has become available for use in parenteral feeds. Adding gln to parenteral feeds has been reported to improve the clinical outcome of intensive therapy and bone marrow transplants (for review see Powell-Tuck, 1997). The present trial was designed to investigate the effect of routine use of gln supplementation in parenteral feeds on morbidity and mortality. A randomized double-blind trial was conducted in patients referred to our nutrition team which supervises all adult parenteral nutrition in this large teaching hospital. Consenting patients (n 167) aged 18-85 years and clinically accepted for parenteral nutrition were included. Patients were excluded if the 24 h infusion feed was below 2 litres, serum creatinine above 200 μmol/l, or they had hepatic failure. Daily intakes of energy and N were determined using a validated computer protocol and were closely similar for the two groups. In those randomized to receive gln 3.8 g of the total N of parenteral feeds was replaced with the equivalent 20 g gln. A minimum N intake of 11 g ensured and adequate intake of essential amino acids. Feeds were individualized, but all included trace elements, vitamins, electrolytes and minerals. Eighty-five patients (fifty-two male) received median 8 (interquartile range 5-13) d of feeds containing gln while eighty-two (forty-nine male) received median 8 (interquartile range 5-15) d of standard feeds.

No difference between the two groups was detected for infective complications. Twenty control patients and fourteen who had received gln died during their hospital admission (NS). Cause of death was not significantly different between the two groups although there were trends towards reduced mortality on gln from sepsis, pneumonia and multiple organ failure, and among patients treated for haematological malignancies. Median length of stay in hospital (LOS) was 32 (range 23-52) d for patients on gln-containing feeds and this was not significantly different from those on control feeds, where LOS was 35 (range 25-55) d. Among three principal directorates in which patients were treated, gln was associated with a statistically significant ($p<0.03$) reduction in LOS in surgical patients (45 (range 29-81) v. 30 (range 19-54) d).

This, the largest trial of parenteral gln supplementation so far, provides little support for the routine use of gln supplementation even in units such as ours which apply rigorous restriction on the use of intravenous feeding. However LOS seemed to be reduced surgical patients and trends which could be clinically important suggested that further work is needed in the context of patients undergoing chemotherapy for haematological malignancy.

Powell-Tuck J (1997) *Lancet* ***350,*** 534

Energy prescribed and energy received during parenteral nutrition in children. By SUSAN MURRAY, ISABEL SMITH, HALINA NAWROCKA, SUSAN HILL, SARAH MACDONALD, MARGARET LAWSON, SARAH LONG, ANTHONY REYNOLDS, KATHRYN BETHUNE and AGOSTINO PIERRO, *Institute of Child Health and Great Ormond Street Hospital for Children, London WC1N 1EH*

At Great Ormond Street Hospital for Children, approximately 350 paediatric patients receive parenteral nutrition (PN) each year. Decisions on starting and stopping PN and on the prescription of energy and nutrient content are mostly made by the doctor responsible for the patient's care, with input from the pharmacist and occasionally the dietitian.

The aim of the present audit project was to assess: (1) the parenteral and enteral energy prescribed and received at start and end of PN and during the course of PN; (2) the main reason for discontinuing PN and its relationship with parenteral/enteral energy intake.

From July to December 1997, 167 patients were assessed at the start and end of an episode of PN. A random sample of patients was also assessed at 7 d (n 39) and 14 d (n 21) from the start of PN. The energy prescribed was obtained from the pharmacy and dietetic prescriptions. The energy received was derived from the volumes of parenteral and enteral solutions administered daily to the patients. Energy values are expressed as a percentage of the estimated average requirements (EAR) for energy (Department of Health, 1991). These represent the average recommended intakes in well children. Data are expressed as median and range in the Table.

There were fifty-nine neonates (< 1 month), eleven infants (aged 1-12 months) ninety-seven children (aged 1-17 years). Patients were from a wide range of specialities, the main ones were intensive care (45 %), haematology/oncology & bone marrow transplant (23 %) and surgery (14 %).

		Start (n 167)	7 d (n 39)	14 d (n 21)	End (n 167)
Enteral energy received	Median	0.0	2.8	2.5	28.2
(% EAR)	Range	0.0 - 118.5	0.0 - 77.6	0.0 - 78.3	0.0 - 154.1
PN energy prescribed	Median		77.1	79.1	68.1
(% EAR)	Range		38.2 - 135.0	27.6 - 122.4	25.5 - 137.2
PN energy received	Median		69.4	71.9	36.4
(% EAR)	Range		9.2 - 122.2	28.2 - 124.5	4.2 - 115.6
Total PN + enteral energy	Median		76.3	88.5	71.5
received (% EAR)	Range		35.6 - 135.1	31.5 - 127.0	8.5 - 166.9

The main reason given for stopping PN (66 % of the subjects) was that the patient had an "adequate or expected adequate enteral intake". However, only 9 % of the patients in whom PN was discontinued for this reason had achieved an enteral intake > 75 % of their EAR.

We conclude that:

(1) the majority of our patients on PN are prescribed significantly less intravenous energy than EAR;
(2) patients were not properly established onto enteral feeding when PN was discontinued;
(3) there was a significant wastage of PN especially on the last day of a PN episode;
(4) the decision to discontinue PN was often made prematurely with insufficient attention being paid to the patient's enteral energy intake.

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: H.M. Stationery Office.

Fluid balance status of patients referred for nutritional support. By DILEEPRAJ N. LOBO[1], KRISTINE BJARNASON[2], JOY FIELD[2], BRIAN J. ROWLANDS[1] and SIMON P. ALLISON[2], [1]*Department of Surgery and* [2]*Clinical Nutrition Unit, University Hospital, Nottingham NG7 2UH*

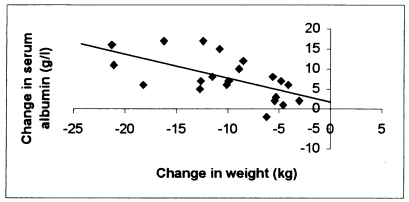
Starvation and the response to injury are associated with inability to excrete an excess Na and water load. Overload causes oedema and may also have adverse physiological effects on gastrointestinal function. The Na and water content of the feed and the patient's initial fluid balance status must be taken into account when prescribing parenteral or enteral feeds. Changes in balance may be deduced from serial daily weights. The present retrospective assessment of clinical signs and fluid balance investigated the significance of oedema in patients requiring nutritional support.

The systematic records of forty-four adult patients referred for nutritional support for ≥10 days between January 1997 and September 1998 were examined. Clinical evidence of presence or absence of oedema was noted. Body weight was recorded before commencement of nutritional support and daily thereafter. The lowest recorded weight subsequent to commencement of nutritional support and the weight at the time of discharge from the nutrition unit were noted. Serum albumin concentrations at these points were recorded. Oedematous patients were initially managed with a zero Na, low volume (2 litres) feed until oedema resolved or weight plateaued. In a few severe cases, concentrated salt-poor albumin and a diuretic were given for the first 48 h.

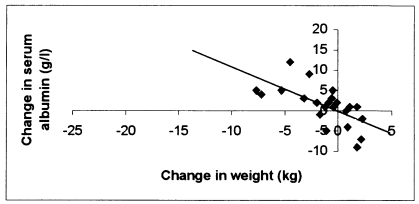
Twenty-one patients had oedema while twenty-three did not. Patients with oedema had had acute surgical conditions and complications such as sepsis that necessitated resuscitation and intensive care, while the non-oedematous patients had chronic conditions with gradual nutritional depletion. Changes in weight and serum albumin concentrations were given in the Table (significance values were calculated by paired *t* test).

	Weight at admission (kg)		Lowest weight after nutritional support (kg)		Weight at discharge from nutrition unit (kg)		Albumin at admission (g/l)		Albumin at lowest weight (g/l)		Albumin at discharge from nutrition unit (g/l)	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Oedematous	79.3	2.9	69.2	3.2	70.1	3.2	21.9	1.0	29.8	1.0	30.0	0.9
		P<0.00001		*P*=0.005				*P*<0.00001		NS		
Non-oedematous	61.4	4.0	60.2	3.9	61.2	3.7	29.2	1.2	30.4	0.9	31.2	1.0
		NS		*P*=0.002				NS		NS		

The fall in weight between admission and the lowest post-nutritional therapy value reflecting negative salt and water balance correlated with the rise in serum albumin concentrations in both groups (Fig.).



Oedematous group (n 21, r –0.61, *P*=0.003)



Non-oedematous group (n 23, r –0.65, *P*=0.001)

Serum albumin concentration changes were inversely proportional to positive salt and water balance suggesting that dilution is a major factor in hypoalbuminaemia in such patients. The importance of control of salt and water in feed prescriptions is demonstrated.

Audit of a home enteral feeding service against the British Association for Parenteral and Enteral Nutrition (BAPEN) standards. By HELEN M. HUGHES and SUSAN LLOYD. *Department of Nutrition and Dietetics, Rhondda NHS Trust, Llwynypia Hospital, Tonypandy, Rhondda Cynon Taff CF40 2LX*

BAPEN have developed procedural guidelines and standards of care (Elia, 1994). The BAPEN recommendations were adapted into local standards. These standards were audited in 1997 and 1998. All home enterally fed patients serviced by Rhondda NHS Trust were surveyed in 1997 (n 37) and 1998 (n 36).

Questions were designed to establish conformity with BAPEN standards. We did not audit the following two standards which we knew were unachievable: (a) there will be a relaxed quiet area suitable for private discussion; (b) there will be a policy for sharing care with the patient's general practitioner.

Examples of the audit questions	1997 No. of respondents 33/37	1998 No. of respondents 33/36
Have you got a patient information pack?	76% 25/33	91% 30/33
Do you know:		
(a) How often to flush the tube?	97% 32/33	100% 33/33
(b) What to do if the tube gets blocked?	91% 30/33	94% 31/33
(c) Who to contact if the pump breaks down?	79% 26/33	94% 32/33
(d) How to set up the feed	100% 33/33	100% 33/33
Do the times of the feed suit you?	91% 30/33	100% 33/37

The initial audit identified patients at risk through lack of knowledge or information. These areas of concern were addressed by information in feedback letters to patients about the questionnaire, by the production of a new home enteral patient information pack and intensive patient education. Audit questionnaires were discreetly coded so that individuals at risk were identified for education.

Overall an 88.8 % conformance to the standards in 1997 was achieved compared with a 94 % conformance in 1998.

These results compare favourably with previous audits in other regions. Whittingham (1996) audited nine hospitals in the West Midlands and found an overall conformity of less than 50 % to the BAPEN standards.

The measured BAPEN standards within the audit are achievable with appropriate investment and practice.

Elia, M. (editor) (1994). *Enteral and Parenteral Nutrition in the Community*. Maidenhead: BAPEN

Whittingham, S. J. (1997). *Proceedings of the Nutrition Society* **56**, 269A.

Functional status of adult patients on home enteral tube feeding in Dublin. By EDEL McNAMARA[1], PHILOMENA FLOOD[2] and NICHOLAS P. KENNEDY[1],[1]*Department of Clinical Medicine, Trinity Centre for Health Sciences, St James's Hospital, Dublin 8 and* [2]*Department of Clinical Nutrition, St James's Hospital, Dublin 8*

Home enteral tube feeding (HETF) is a rapidly expanding area of nutrition support, increasing at a rate of 25 % annually in the UK. However, due to the poor outcome in geriatric dysphagic patients, the appropriateness of HETF for these patients had been questioned (Howard, 1997).

Considering the lack of details available at present regarding these patients in Ireland, we carried out the present survey to investigate the functional status of adult patients on HETF in Dublin. Fifty patients were surveyed. Patients were surveyed in their own homes (42 %) and in nursing homes (58 %). Indications for HETF in this sample were stroke (46 %); cancers affecting swallowing (24 %); Alzheimer's disease and Parkinson's disease (6 %); cerebral palsy (4 %); multiple sclerosis (4 %), and other indications (16 %).

The Barthel Activities of daily living (ADL) index (Mahoney & Barthel, 1965) and Norton index (Norton, 1996) measurement scales were carried out on all patients. Only six patients could leave their home unaided and just one patient on HETF continued to work (self employed). Stroke patients were older, showed considerably less functional ability, and had lower scores in activities of daily living rating scales, as outlined in the Table.

	Stroke patients (*n* 23)	Cancer patients (*n* 12)	Other patients (*n* 15)
Age (years)	78 (SD 10)	59 (SD 10)	61 (SD 27)
% Male	61	100	29
% Female	39	0	71
Place of residence (%)			
Lives at home	22	92	29
Lives in nursing home/ other institution	78	8	71
Is the patient house-bound?(%)			
Yes	83	23	50
No	17	77	50
Patients speech communication (%)			
Normal	13	46	29
Slight impairment	22	15	21
Major / minor difficulty	48	39	21
Nil	17	0	29
Patients mobility level (%)			
Able to walk unaided	4	92	14
Able to walk with aid	18	8	7
Unable to walk	78	0	79
Assistance with HETF (%)			
No assistance necessary	0	39	7
Some assistance necessary	0	38	7
Full assistance necessary	100	23	86
Does the patient currently have a good quality of life?*(%)			
Yes	39	85	50
No	61	15	50
Incontinent (bowel and bladder) (%)	70	0	71
Norton scale index†	15.5	22.6	14.8
Barthel ADL index‡	2.8	16.3	3.6

*In the opinion of the primary carer/subjective assessment of interviewer.
†Norton Scale: a maximum score of 28 indicates unlimited mobility/ability to carry out the activities of daily living.
‡Barthel ADL Index: a method to assess functional status and/or quality of life (maximum score of 18).

Stroke patients on HETF can spend between 193 and 477 d on feeding before death or resuming oral nutrition (McNamara, 1998). Considering the poor functional status of stroke patients in our survey, the benefit of using HETF in these patients in Ireland needs to be established by comparison with similar patients in the community who are not tube fed.

Howard, L (1997) *American Journal Clinical Nutrition* **66**, 1364-70
Mahoney, F & Barthel, D (1965) *Maryland State Medical Journal* **14**, 61-65.
McNamara E, Flood P & Kennedy NP (1998) *Proceedings of the Nutrition Society* (In the Press).
Norton, D (1996) *Advanced Wound Care* **6**, 38-43

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Complications experienced by patients on home enteral tube feeding in Dublin. By EDEL McNAMARA[1], PHILOMENA FLOOD[2] and NICHOLAS P. KENNEDY[1],[1]*Department of Clinical Medicine, Trinity Centre for Health Sciences, St James's Hospital, Dublin 8 and* [2] *Department of Clinical Nutrition, St James's Hospital, Dublin 8*

Home enteral tube feeding (HETF) is an increasingly popular practice in Britian and Ireland. Complications of HETF with varying rates of occurrence have been reported. We undertook the present retrospective survey to document the complications experienced by patients on HETF in Dublin. Fifty adult patients were surveyed in the community, using an interviewer-assisted questionnaire. Relevant details regarding readmissions to hospital were extracted from hospital medical and dietetic records.

There were more males (64 %) than females (36 %) in the group, with an average age of 68 (SD 18) years. Less than half of the sample (42 %) lived in their own home, while 58 % resided in nursing homes or other long-term care facilities. Four patients had spent more than 1000 d on HETF, six had spent between 500 and 1000 d, 31% between 100 and 500 d and the remaining 49 % of patients were on HETF for an average of 38 (SD 25) d. The total length of time spent on HETF by the sample was 49 man years. Indications for HETF in this sample patients were stroke (46 %); cancers affecting swallowing (24 %); Alzheimer's disease and Parkinson's disease (6 %); cerebral palsy (4 %); multiple sclerosis (4 %), and other indications (16 %). Complications experienced by the patients are outlined in the Table.

Complication associated with HETF	Patients who experienced complication (%)	Comments
Gastrostomy site complications†:		
Pain at stoma site	27	No patients experienced severe pain at stoma site
Erythema at stoma site	47	More common in patients on HETF for less than 3 months*
Leakage of feed at the stoma site	8	Resolved for all patients after a short period
Discharge around stoma site	27	These patients were more likely to have had a site infection**
Local infection at stoma site	16	37 % of these required a hospital visit to deal with this problem
Mechanical complications:		
Tube blockage	30	4 patients required hospital visit to un-block tube‡, 2 had tube replaced
Tube replacement	26	8 patients had tube replaced once, 5 had tube replaced twice
Gastrointestinal complications:		
Nausea	32	Cancer patients were more likely to suffer nausea than patients with stroke
Vomiting	40	Incidence of vomiting was not significantly greater in cancer patients
Diarrhoea	34	Those on fibre-containing feeds experienced significantly less diarrhoea*
Constipation	48	Ambulant patients experienced significantly less constipation*
Abdominal distention	16	Patients eating food orally were more likely to have abdominal distention*
Regurgitation of feed	28	Patients suffering from cough were more likely to regurgitate their feed***
Other complications:		
Pneumonia	34	More common in patients on HETF for more than 100 d*** 41% of these patients required hospitalization

*$P<0.05$, **$P<0.01$, *** $P<0.001$.
†n=49 as 1 patient was fed by nasogastric tube.
‡All 4 patients came from nursing homes.

These findings compare favourably with data from a recent survey of HETF in a region of Northern Ireland (L'Estrange, 1997), but our complication rates appear high when compared with those found in a region in England (Parker *et al.*, 1996). In particular, the levels of pneumonia and tube blockages requiring hospitalization experienced by our patients in the community seem high. These findings require further investigation.

L'Estrange F (1997) *Journal of Human Nutrition and Dietetics* **10**, 277-287.
Parker T, Neale G & Elia M (1996) *European Journal of Clinical Nutrition* **50**, 47-53.

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One years experience of a multidisciplinary percutaneous endoscopic gastrostomy (PEG) clinic.
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The use of PEG is increasing, and consequently more patients are being discharged home on home enteral nutrition (HEN). At present there are approximately 100 patients in the King's College Hospital area on the HEN register. Before the introduction of a PEG clinic in this area there was no integrated multidisciplinary assessment of these patients after discharge.

Adult patients on the HEN register were contacted and asked to attend the clinic which ran monthly. Each patient was assessed by the doctor, nurse, dietitian and speech and language therapist as appropriate. Findings were collated onto the clinic database, and the first 12 months experience is presented here.

Forty-four patients attended the clinic on fifty-six occasions, twenty-six were female and the median age was 76 (range 39-93) years. Thirty-eight had a PEG inserted following a stroke. Forty-one patients had a PEG inserted due to the presence of acquired dysphagia. Of these, thirty-three were not following speech therapy dysphagia recommendations regarding oral intake following discharge from hospital and thirteen demonstrated improvements in the status of their swallow. All patients were assessed by the dietitian and nineteen patients had their feeding regimens altered after the first clinic. Most patients had a BMI in the range of 19-24 kg/m^2. Thirteen patients had sore or infected PEG sites and fifteen needed the PEG ends replacing. The doctor assessed all patients and made changes in medication in twenty-six patients, mostly the initiation of asprin for the secondary prevention of stroke. Unmet social and emotional needs were found in both patients and carers. Within the first year, full oral feeding was initiated in twelve patients following their attendance at the clinic. These patients subsequently had their PEG removed. Four patients needed their PEG replacing.

This clinic has highlighted the changing needs of this patient group and indicated that regular multidisciplinary review is therefore necessary in the years post insertion of a PEG.

High international normalized ratio (INR) is a potential problem in patients referred for percutaneous endoscopic gastrostomy.
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Percutaneous endoscopic gastrostomy (PEG) is now being used widely as a means of administering nutrition for those who are unable to meet their requirements orally. Although it is safe, PEG insertion is an invasive procedure with potential complications like haemorrhage. Not every hospital makes it a policy to check the patients' INR (a measure of the coagulability of blood) before the procedure and there are no data in the literature to support such a practice. We therefore undertook a prospective study examining the INR of 100 consecutive patients referred for the placement of a PEG.

When a patient was referred for a PEG, we requested for an INR to be checked before the procedure. Out of the 100 patients, sixteen did not have their INR checked. Of the eighty-four patients whose INR was checked, sixteen (i.e. 19 %) had abnormal INR ranging from 1.33 to 2.81 (mean 1.77; normal 1). Three of these patients had INR of more than 2. We studied the clinical records of these fourteen patients to ascertain a cause for these abnormal INR (we were unable to retrieve the clinical records of two patients). Four patients were on Warfarin; three for venous thrombosis and one for cerebral vascular disease. Ten patients including two with INR more than 2 were not on Warfarin and no obvious explanation was apparent.

The indications for PEG in these ten patients were dysphagia secondary to stroke and dementia, and one bronchogenic carcinoma causing oesophageal compression. They were elderly patients ranging from 70 to 86 years of age (mean age 77.5 years) and had similar characteristics, which included normal or mildly deranged liver function tests, no history of liver disease, poor nutritional intake during hospitalization and sepsis treated with antibiotics. Only four of these ten patients were given parenteral vitamin K, and three of the four patients showed normalization of their INR. One patient did not have a repeat INR checked following vitamin K administration.

We believe that the abnormally high INR observed in these ten patients could have been due to vitamin K deficiency. Vitamin K is essential in the synthesis of clotting factors and proteins. It is readily available from our diet and synthesis from intestinal bacteria also contributes significantly to our body store. We hypothesize that in these ten patients, a combination of nutritional depletion, increased vitamin K utilization during sepsis and the use of antibiotics resulting in a change in the normal intestinal bacteria flora led to a rapid depletion of the body's store of vitamin K. Certainly in the three patients to whom parenteral vitamin K was given, the INR returned to normal .

This study revealed a high prevalence of abnormally high INR among patients referred for PEG and not taking Warfarin, and who are therefore at risk of developing a bleeding complication. We recommend that all patients referred for PEG should have their INR checked and corrected if abnormal before the procedure. Other therapeutic endoscopic procedures such as endoscopic retrograde cholangiopancreatography are not contemplated without it. Whether the introduction of this practice reduces clinical risk needs to be studied prospectively in a larger trial.

Monitoring changes in allograft function after small bowel transplantation in children. By S.V.BEATH, A.DALY, S.CLARK, D.A.KELLY, J.A.C.BUCKELS, A.D.MAYER and J.DE VILLE DE GOYET, *Birmingham Children's Hospital, and Queen Elizabeth Hospital, Birmingham B4 6NH.*

Identifying intestinal allograft complications at an early stage remains a clinical problem. The aim of the present study was to evaluate allograft function by volume of ileostomy output and tolerance of feed, and to relate these to proven complications. Six intestinal transplants (four combined liver and bowel, two isolated bowel) were performed in six children with: short gut (one), microvillus inclusion disease (two), and pseudo obstruction (three), aged 2-7 years. All subjects had distal ileostomies and the complications occurred between two weeks and six months after transplant. Immune suppression was maintained by administration of oral tacrolimus.

Complication	Number of episodes	Mean ileostomy increase(%)	Mean intake: output	Fever	Mean tacrolimus level (ng/ml)
Rejection	4	90	0.58[a]	4/4	10
Septicaemia	4	75	1.11[a]	2/4	17
CMV	2	13	1.21[a]	2/2	30
PTLD	1	89	0.57[a]	1/1	24
Well	6	2	2.2[b]	0/6	15

PTLD, post transplant lymphoproliferative disease, CMV, cytomegalovirus
Statistics by unpaired t test. a compared to b= p<0.001 (2-tail)

Although the numbers were small, the ratio intake volume (feed and drinks orally): volume of ileostomy fluid produced in 24 h was very significant in distinguishing health from complications ($p<0.001$). The intake:output value did not distinguish between rejection and septicaemia in this small sample, which may be because rejection is often associated with sepsis. However, CMV disease produced less graft dysfunction than rejection. In the single patient with PTLD increased ileostomy output was a major feature. Increased ileostomy output was generally less sensitive than the ratio. The final diagnoses were made by a combination of endoscopy, histology, CMV polymerase chain reaction and blood culture.

We conclude that the intake:output ratio is a useful index of graft function which can be used by the patient at home.

Feeding practices in special care baby units: a survey of units in the United Kingdom. By L.D. MARRIOTT[1], J.A. BISHOP[1], K.D. FOOTE[2], A.C. KIMBER[1] and J.B. MORGAN[1], [1]*University of Surrey, Guildford GU2 5XH,* [2]*Royal Hampshire County Hospital, Winchester SO22 5DG*

A survey was conducted to determine the current feeding practices for low-birth-weight (LBW) infants in special care baby units and the post-discharge feeding advice provided to parents by the units. A three-page questionnaire was sent to 114 units, randomly selected from the eleven Regional Health Authorities in the UK. The SPSS statistical package was used for statistical analysis.

The questionnaire was designed to elicit information regarding the use of LBW formulas and breast-milk supplements in special care baby units, the types of infant milks recommended at about the time of discharge from the unit and the feeding policies or recommendations post-discharge for preterm and small-for-gestational age infants. Seventy-two completed questionnaires were returned (63 % response rate).

The units surveyed admitted up to 400 LBW infants/year, with a median admission rate of 125 infants/year. Of the units 11 % (7/65) did not use a breast-milk fortifier (BMF) to supplement the milk of breast-feeding mothers. Where BMF was used, infant weight was the most frequently used variable to determine when the supplement would no longer be offered. Most units (72 %), offering BMF, used weight or a combination of weight and age, as the determinant of BMF withdrawal. Of these special care baby units, 55 % used 2.0 kg as the cut-off point, 17 % used 2.5 kg and the remainder used weights below 2 kg, predominantly 1.8 kg.

All units that responded to the question concerning their use (71/72) used LBW formulas; 93 % of units (66/71) gave infant weight or a combination of weight and age as the determinant of replacement of LBW formula by an alternative formula for bottle-fed babies. These units withdrew LBW formula at infant weights ranging from 1.5 to 2.6 kg (mean 1.96, SD 0.21 kg). The two most frequently chosen infant weights for LBW formula withdrawal were 2.0 kg (47 % responses) and 1.8 kg (36 % responses). Some 57 % (40/70) of units used or recommended the use of a post-discharge LBW formula for some infants. In the main, units used infant weight as the determinant of post-discharge LBW formula withdrawal (70 %).

Paediatricians in all but one unit, (71/72), prescribed one or more vitamin supplements to some or all of their LBW infants. Most units recommended multivitamin drops alone (45 %) or multivitamin drops and folic acid (44 %). Paediatricians in 89 % of units (64/72) prescribed one or more mineral supplements to some or all of their LBW infants. In 94 % of these units an Fe supplement was used, either alone or in combination with other minerals.

Only 3 % (2/72) of units had a written post discharge feeding policy for the parents of LBW infants. Health visitors, either alone or in combination with other health professionals, were identified as the primary providers of nutritional advice after hospital discharge by the greatest number of units (51 %). Only 7 % (5/69) of units assigned dietitians to this role.

There appears to be a wide divergence of feeding practices with respect to the use of BMF, LBW formulas and post-discharge LBW formulas in neonatal units. The threshold weights at which BMF and LBW formula ceased to be provided were usually well under the limit of definition of LBW, i.e. 2.5 kg. The majority of units withdrew LBW formula and BMF when infants weighed 2 kg. A large proportion of units (43 %) did not recommend the use of post-discharge LBW formulas. The use of vitamin and mineral supplements in the units appeared to be more homogeneous than that of milk supplements, although a minority of units (11 %) did not prescribe mineral supplements. The fact that the overwhelming majority of units did not provide parents with written post-discharge guidelines for feeding LBW infants is a cause for concern.

The relative importance of endoluminal and extraluminal colonization in the pathogenesis of catheter related sepsis in the central venous catheter. By JIN J. BONG, PETER KITE, BRIAN M. DOBBINS, MARK H. WILCOX and MICHAEL J. McMAHON, *Department of Surgery and Microbiology, Leeds General Infirmary, Leeds, LS1 9JT.*

For the past two decades the dominant theory of the pathogenesis of catheter related sepsis (CRS) has centred on the skin entry site as primary source of infection, with subsequent extraluminal colonization down to the catheter tip. This hypothesis has rarely been challenged but fundamental flaws in methodology suggest it may not be the case. We evaluated 238 catheters in surgical patients who were suspected to have CRS, using a traditional extraluminal culture technique (Maki *et al.* 1977) and a combination of endoluminal techniques, including endoluminal brush (Kite *et al.* 1997) and modified Cleri's flush (Cleri *et al.*1980). We defined CRS as an externally or internally colonized catheter (>100 colony forming units) with the same organism recovered from blood culture. A colonized catheter is defined as one containing more than 100 colony forming units which were not isolated from blood culture.

	Colonization of external surface	Colonization of internal surface	No. of cases
Uninfected catheter	0	0	112
Colonized catheter	45 (76%)	*30 (51%)	59
CRS	52 (78%)	*64 (96%)	67

*p value <0.001

In 96 % of cases of CRS, the internal surface of the catheter was significantly colonized by organisms which were also isolated from blood culture. There was colonization of the external surface of the catheter in only 78 % of cases of CRS. In addition, 10 % of organisms isolated from the external surface of the catheter did not match isolates from blood culture.

The present study shows the relative importance of endoluminal colonization of the catheter in the pathogenesis of CRS. The results were supported by scanning electron microscopy which showed an extensive biofilm formation and prolific colonization on the endoluminal surface against a relatively clean extraluminal surface, which is subjected to contamination when the catheter is withdrawn.

We conclude that endoluminal colonization of the catheter is associated with CRS. Endoluminal brushing *in vivo* provides a more sensitive and specific technique for the detection of CRS, without the need to remove the catheter.

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Maki DJ, Weis CE & Sarafin HW (1977) *New England Journal of Medicine 296*;1305-1309.

Tunnelled central venous catheters: insertion best practised in radiology suite with screening facilities? By PAUL KITCHEN, CLIVE ONNIE, JAMES HART, ANGIE DAVIDSON and ALASTAIR FORBES, *Department of Clinical Nutrition, St Mark's Hospital, Harrow, HA1 3UJ.*

Controversy exists over the hospital setting in which tunnelled central venous catheters (TCVC) are best inserted. A recent review recommended open surgical placement using general anaesthesia in the operating theatre, but also a preference for peripherally inserted catheters on grounds of economy (Gilbert *et al.* 1997). A referral centre has therefore reviewed its TCVC placement practice for chronic intestinal failure patients.

A total of 821 lines were inserted between July 1974 and February 1998 (mean 32.8/year). Peripheral lines were not used for these patients as expected duration of use is always in excess of 1 month. Procedures were mainly performed in a dedicated room adjacent to the ward, with immediate reporting of portable chest radiographs, or in the radiology department. Most were inserted by experienced physicians using local anaesthesia and intravenous sedation, but twenty (2.4 %) were inserted surgically, usually because of a perceived need for general anaesthesia in especially nervous patients, but occasionally because of a need for open cut-down onto the subclavian vein. Complication rates for the different venues and techniques were thought to be similar, but to ascertain whether this was actually so, the TCVC insertions of 1997 were reviewed in more detail.

In 1997 there were forty-one procedures. Sixteen were replacements (catheter sepsis: primary or secondary; or broken lines), and twenty-five were new lines. The average life-span of lines before replacement was 3.4 years. Two procedures were surgical, due to patient tolerance issues, and both were performed under general anaesthetic, with an open approach with which the surgeon was more familiar. One known difficult cannulation was done with synchronous fluoroscopic screening; the remainder were done without screening on the ward or in a radiology procedure room, by a consultant gastroenterologist or by senior gastroenterology trainees. Two pneumothoraces occurred: one following open surgical placement required a chest drain; the other resolved without intervention. There was no short-term catheter sepsis; two late occurrences of sepsis (>3 months) were considered unrelated to the insertion event. There were no other complications.

If experienced operators are available, TCVC can be inserted without screening or an open approach, reserving fluoroscopic guide-wire screening facilities for predicted difficult cases. This practice is safe, has a low complication rate and is cost effective.

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Nutritional status of patients on admission too acute services of a London teaching hospital. By SHONA VLAMING, ANZONETTE BIEHLER, SANTANU CHATTOPADHYAY, CRAWFORD JAMIESON, ADAM CUNLIFFE and JEREMY POWELL-TUCK, *Department of Human Nutrition, Royal London Hospital, London, E1 2AJ*

Previous studies have shown that 20-50 % of hospital patients are undernourished (Powell-Tuck, 1997), and that close to 40 % have a BMI less than 20 kg/m^2 (McWhirter & Pennington, 1994).

We recruited 998 patients admitted through the accident and emergency department to general medicine (GM), general surgery (GS) and orthopaedics (O). Weight, height and mid-upper arm circumference (MUAC) were assessed, and (BMI) calculated. The mean age of patients was 59.1 (SD 18.2) years, 557 were male and 441 female. Of the 423 patients from which it was possible to determine BMI, the mean values of 25.2 (SD 5.0) kg/m^2 for males and 25.4 (SD 6.2) kg/m^2 for females were found. These were similar to the means for the general population at 25.7 kg/m^2 for men and 25.4 kg/m^2 for females (Breeze *et al.* 1994). There was no significant difference between the BMI in patients in different directorates

The Table below gives the percentages of men and women, under 65 years of age, with a BMI in the range <20 - >30 kg/m^2, from the present study, the McWhirter & Pennington study (1994) and the general population (Gregory *et al.* 1990).

	Men (%)			Women (%)		
BMI	General Population	Study group	McWhirter	General Population	Study group	McWhirter
<20	6	15	23	12	18	29
20.1-25	49	36	37	52	35	33
25.1-30	37	32	34	24	27	18
>30	8	17	6	12	20	21

Our Table shows that the percentages of underweight men and women in the present study were significantly greater (P<0.001) than those in the general population as indicated in the Health of the Nation survey (Gregory *et al.* 1990) but lower than those found in the study of McWhirter & Pennington (1994). It appears that care needs to be exercised in extrapolating information from one hospital population for use in another.

It was possible to obtain both weight and height on admission in only 42 % of patients recruited. However, there was no significant difference in MUAC between patients in whom BMI was and was not measured (29.1 (SD 4.6) cm *v.* 29.3 (SD 4.9) cm). This strongly suggests that the data we have reported regarding the BMI of the subjects in this study were not skewed by the omission of measurements from underweight patients. This notion is reinforced by our finding that MUAC was significantly predictive (P<0.001) of BMI when a regression analysis was performed in subjects from whom both BMI and MUAC had been obtained. It is possible, therefore, that MUAC may be a useful surrogate for BMI where height or weight measurements cannot be made, a common situation in populations of acutely ill patients.

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McWhirter JP, Pennington CR (1994) *British Medical Journal* **308**, 945-948.

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Gregory J, Foster K, Tyler H & Wiseman M (1990) *The dietary and nutritional survey of British Adults*, London: HMSO

Development and validation of nutritional risk assessment for routine use in an acute hospital Trust. **By RACHAEL BARLOW, DONNA G DUNCAN, JUDYTH JENKINS & KERENZA HOOD.** *Department of Nutrition & Dietetics, University Hospital of Wales Healthcare NHS Trust, Heath Park, Cardiff. Department of General Practice, University of Wales College of Medicine, Llanederyn Health Centre, Cardiff*

Malnutrition continues to be a significant problem in hospitalized patients (McWhirter & Pennington, 1994) and it is suggested that early recognition and intervention in patients at high nutritional risk can improve outcome. In 1996 a multidisciplinary group of nurses, dietitians and managers reviewed the nutrition risk assessment (NRA)/nutrition screening tools in the published literature and those in use locally with the aim of identifying one suitable for use throughout the Trust. Many of the NRA tools reviewed had not been validated, or contained measurements such as height and weight which were difficult to obtain in patients in the acute phase of illness. The group concluded that key characteristics should be selected that were readily available from admission information to develop NRA more appropriate for use across an acute hospital trust. The NRA tool developed included weight history, appetite, ability to eat, stress factors and pressure sores/wounds and was subsequently named the WAASP Test to reflect the categories it contained. The WAASP Test was specifically designed for use both on admission and throughout the hospital stay to identify patients at low, moderate and high nutritional risk.

Validation of the WAASP Test was carried out against clinical measures including albumin, haemoglobin, BMI and reported percentage weight loss plus current food intake and medical diagnosis. The criteria were selected from objective clinical measures routinely available by an 'expert' group of dietitians drawn from within the Trust to try to minimize differences in assessment practices between dietitians in different specialities that have been reported elsewhere (Bryan et al. 1998). The WAASP Test was then piloted on 100 subjects across different specialities including medical, nephrology, surgical, trauma, orthopaedic and rehabilitation. No major changes were made to the content of the WAASP Test but the format was altered to reverse the order of scoring on the questions. The validation process was subsequently repeated on thirty-nine subjects.

The WAASP Test has been shown to be valid for use in all use in all adult patients except in obstetrics and gynaecology where it was not tested. Initially good agreement was found between assessment using the WAASP Test and the objective clinical criteria selected by dietitian. There were some anomalies identified between the coring of the WAASP Test section on appetite by nurses and current food intake measured by dietitian, but when investigated these could be explained as the nurses assessed previous rather than current intake. The final format if the WAASP Test when completed by nursing staff showed reasonable agreements with the criteria selected by the 'expert' dietitians (kappa = 0.38). The WAASP Test has the potential to improve nutrition for patients in acute care by early identification of nutrition risk followed by appropriate intervention. A research project is currently underway to assess the clinical effectiveness of using the WAASP Test in routine clinical practice. This will include the effect of an educational intervention on correlation between dietitian and nurses completing the WAASP Test.

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Validation a of nutritional screening tool; testing the reliability and validity. By S.T. BURDEN, S. BODEY, Y.J. BRADBURN, F. ENGLAND, S. MURDOCH, A.L. THOMPSON, J.M. SIM and A.M. SOWERBUTTS, *Dietetic Department, Withington Hospital, Nell Lane, Manchester M20 2LR*

The nutritional screening tool has been designed for use by nursing staff and is included in the hospital standard admission procedure. The screening process allocated every patient a score categorizing them into minimal risk (<10), moderate risk (10-14) and malnourished (>15), each category outlined an appropriate course of action to be taken. The validation process concentrates on examining the reproducibility of the tool and its accuracy in determining the incidence of malnutrition in hospital. The sample comprised 100 patients from medical, surgical, elderly care and renal specialities. The study population consisted of sixty-seven women and thirty-three men, the mean age was 63 (range 25-93) years, and nine wards were used for recruitment. For the validation process nurses and dietitians completed the screening tool on the same patient at ward level; these results were evaluated for inter-observer error. The level of validity was determined by comparing the scores from the screening process, which indicated malnutrition, with markers used to measure nutritional status. The markers used to detect malnutrition were BMI <20 kg/m^2, mid-arm circumference (MAC) <25th centile when compared with standard tables (Jelliffe, 1966), weight loss > 10 % in the previous 6 months and an energy intake < 25 % of the patient's estimated energy requirements (Department of Health 1991).

The difference between nurses' and dietitians' scores	Actual %	Cumulative %
plus/minus 0	44	44
plus/minus 1	28	72
plus/minus 2	21	93
plus/minus 3	2	95
plus/minus 4	4	99

	Patients within score category <10 (%)	Patients within score category 10-15 (%)	Patients within score category >15 (%)
Number of variables indicating malnutrition	Minimal risk	Moderate risk	Malnourished
0	63	38	6
1	27	30	23
2	3	22	12
3	6	8	52
4	0	2	6

The results for the reliability show a 95 % level of agreement between nurses and dietitians within +/-3; only 8 % of the scores placed patients into a different category which would affect subsequent care. How accurately the screening tool determines malnutrition is compromised by the large scale implementation and use of the tool. The screening tool is used primarily by staff who have no formal training in nutrition and who have limited time to complete procedural tasks. These constraints have played a fundamental role in the initial design of the tool and the comparison of the tool with markers used to determine nutritional status reflects this to a large extent. An evaluation of validity is further impaired by the lack of an accepted 'gold standard' to determine nutritional status. The emphasis on realism has increased the practicality of implementation and ease of completion, but decreased validity in the domains of precision and generalization (Brinberg, 1985).

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Nurse awareness and knowledge of nutrition. By MATTHEW LOUGH, JANE COLLIER, MARGARET NEW and JAMES ROSE, *The Nutrition Team, The Ayr Hospital, Dalmellington Rd, Ayr, KA6 6DX.*

Nutrition care has increased in complexity over the past 20 years. The prevalence of malnutrition in hospital has changed little in that time (McWhirter & Pennington, 1994). This is despite reports and guidelines dealing with nutrition problems (British Association for Parenteral and Enteral Nutrition, 1996) in which the importance of nurse education and acquisition of technical skills in nutrition care is highlighted. The aim of the present study was to assess nurse knowledge in key areas and to identify their nutrition training and education needs. This was done by a questionnaire devised by the nutrition team. Questions were asked about nutrition assessment on admission, the recognition of nutrition problems, the nutrition team, the role of nutrition in clinical practice, nutrition education in nursing school and training in practical nutrition. Twenty-four nurses from D to G grade were chosen at random from two medical and two surgical wards in the hospital. Of nurses, 71 % said they weighed patients on admission. The reasons for not weighing were documented; nurses did not give weight being unimportant as a reason. The majority (67%) of nurses gave the incidence of malnutrition in hospital as 25-50 %. They all thought that nutrition was important for clinical outcomes. Nurses thought they should be responsible for referrals to the nutrition team and that meal supervision was their responsibility and not that of doctors or care assistants. All the nurses received nutrition education at nursing school, with 75 % considering that it was inadequate for day-to-day nutrition care. They all felt the need for education and training in nutrition to provide up-to-date nursing care. Nurses expressed the view that they had a central role in the provision of good quality nutrition support and care. This is a view endorsed by the Royal College of Nursing (1996). We conclude from this study that a nutrition education programme and a series of training modules in practical nutrition techniques is required to provide nurses with the skills required to provide up-to-date nutrition support.

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Treatment with ornithine aspartate (Hepa-Merz) restores muscle protein synthesis responsiveness to feeding in patients with liver cirrhosis. By N. Reynolds[2], S. Downie[1], K. Smith[2], M J Rennie[2],[1] *Department of Anatomy and Physiology, University of Dundee, DD1 4HN and* [2] *Department of Digestive Disease and Clinical Nutrition, Ninewells Hospital, Ninewells Hospital, Dundee DD1 9SY.*

Lean tissue wasting is characteristic of liver disease and is associated with a poor prognosis. Enteral and parenteral nutrition have been employed to reverse muscle wasting but the response has been variable and unpredictable.

We chose to investigate the effects on muscle protein metabolism of supplemental ornithine aspartate, which has been reported to ameliorate the metabolic disturbances in cirrhosis. Sixteen patients with alcoholic liver cirrhosis were randomized to receive ornithine aspartate (40 g) or placebo intravenously for 7 d. All patients had muscle wasting and had reached a similar stage of severity of disease (Child -Turcotte scores 7-12). On days 1 and 7 in the post-absorptive state the patients underwent a metabolic study using a primed continuous infusion of [1-^{13}C] leucine (1 mg/kg prime and 0.1 mg/kg per hour). After a 4 h fast the patients received an enteral feed in half-hourly aliquots equivalent to 0.2 g N/kg and 6 kJ/kg per 24 h reduced *pro rata* over 4 h. After each 4 h fast or fed period percutaneous biopsies of anterior tabialis were obtained to determine the muscle protein synthetic rate using established techniques During the 7 d of treatment all patients received nutritional supplements to ensure that daily nutritional needs were met. No patients were taking medication known to affect muscle protein metabolism.

Table. Muscle protein synthesis (% per h) in patients receiving ornithine aspartate or placebo

	Ornithine Aspartate				Placebo			
	Fast		Feed		Fast		Feed	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Day 1	0.051	0.015	0.044	0.009	0.047	0.016	0.046	0.016
Day 7	0.047	0.015	0.071	0.022*	0.035	0.012	0.049	0.023

Mean value was significantly different from placebo:* $P<0.05$ (one-tailed, paired Student's t test).

In normal subjects feeding is associated with an increase in protein synthesis. Although the cirrhotic patients given the placebo showed no response to feeding, the normal effect was restored in those cirrhotic patients receiving 7 d with ornithine aspartate. This observation may have important potential clinical benefits.

The effect of oral glutamine supplementation on growth faltering in Gambian infants. By E.A. WILLIAMS[1], M. ELIA[1], L. UMAR[2] and P.G. LUNN[1], [1]*MRC Dunn Nutrition Unit, Milton Road, Cambridge CB4 1XJ and* [2]*Keneba, The Gambia*

Infant growth in developing countries frequently falters at about 3-4 months of age and catch-up growth is not seen until 3 years of age. For Gambian infants growth faltering has been shown to be strongly associated with a deterioration in the small-intestinal mucosa and an elevation in acute-phase proteins, which may be the result of a breakdown in intestinal barrier function which normally prevents entry of pathogens into the body (Lunn *et al.* 1991). Glutamine is the primary substrate for the small intestine (Windmueller, 1982), and has been reported to have a variety of beneficial effects in animals including trophic effects on the small intestine, improvement in intestinal barrier function and improvement in immune function. Glutamine has also been reported to act as a conditionally essential nutrient in disease and to improve N balance in both animals and man (Lacey & Wilmore, 1990). Therefore it was hypothesized that glutamine supplementation in growth faltering infants may improve growth and small-intestinal function and reduce markers of systemic inflammation.

Ninety-three infants, between the ages of 4 and 11 months were recruited over 2 years from six villages in the West Kiang region of The Gambia. Infants were randomly assigned in a double-blind, placebo-controlled manner to receive either glutamine or an isonitrogenous, isoenergetic mix of non-essential amino acids. Infants were orally supplemented with 0.5 g/kg body weight each day for the duration of the rainy seasons of 1996 and 1997 (June-October). The supplement was given in two doses (a.m. and p.m.). The infants were supplemented for an average of 3.42 (se 0.029) months. Infants attended clinic at 4-weekly intervals when anthropometric measurements were made, the intestinal permeability test was performed and the infants were clinically examined. Finger-prick blood samples were taken at the beginning, middle and end of the supplementation period for the analysis of C-reactive protein (CRP) and immunoglobulins. The mean weight-for-age and length-for-age z scores of the two groups over the supplementation period are shown in Figs 1 and 2 respectively.

Fig. 1

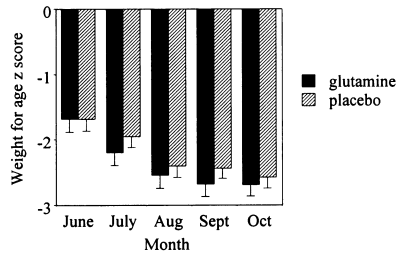
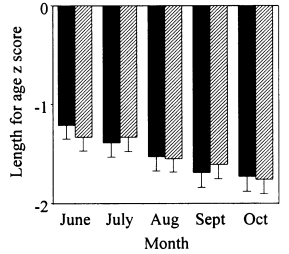


Fig. 2



There was a seasonal deterioration in the weight-for-age and length-for-age z scores in both groups of infants during the supplementation period. Glutamine supplementation did not have a significant effect on the weight-for-age and length-for-age z scores. The mean intestinal permeability values, expressed as lactulose:mannitol ratio in the glutamine (0.41 (se 0.023)) and placebo (0.35 (se 0.021)) groups were not significantly different (mean UK lactulose:mannitol value for this age group of infants, 0.12 (se 0.02)). Mean concentrations of immunoglobulins and CRP in the glutamine and placebo groups respectively were as follows : IgA 0.67 (se 0.035) *v.* 0.57 (se 0.039) g/l, IgG 9.57 (se 0.316) *v.* 9.46 (se 0.325) g/l, and CRP 6.63 (se 1.042) *v.* 7.35 (se 1.457) g/l and were not significantly different between the groups (normal ranges: IgA 0.08-0.80 g/l, IgG 2.2-9.0 g/l, CRP 0.02-6.0 g/l).

This study suggests that in this population of infants, glutamine supplementation produced no improvement in infant growth and no reduction in the abnormally high intestinal permeability or in the circulating markers of systemic inflammation.

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The effect of a single exercise session on postprandial chylomicron, VLDL and total plasma triacylglycerol concentrations. By JASON M.R. GILL and ADRIANNE E. HARDMAN *Human Muscle Metabolism Research Group, Loughborough University, Loughborough, LE11 3TU*

It has been reported that the lipaemic response to an oral fat challenge is attenuated by a single exercise session performed some hours earlier (e.g. Tsetsonis & Hardman, 1996). However, little is known about the qualitative and quantitative changes to lipoprotein species elicited by moderate exercise. The purpose of the present study was, therefore, to determine the influence of a moderate intensity exercise session on postprandial plasma chylomicron (CM), VLDL and total triacylglycerol (TAG) concentrations.

Twelve men, mean age 51.5 (SD 5.9) years, BMI 24.6 (SD 3.7) kg/m^2, VO_2 max 36.8 (SD 5.5) ml/kg per min, fasting TAG 1.27 (SD 0.89) mmol/l, fasting total cholesterol 5.24 (SD 0.90) mmol/l, participated. All were free from coronary artery disease as defined by a 12-lead exercise electrocardiogram. Subjects undertook two trials, each over 2 d in a balanced crossover design. Subjects refrained from exercise for 2 d before each trial. On the afternoon of day 1, subjects either rested (control) or performed 90 min treadmill walking at 61.9 (SD 3.0) % VO_2 max, representing a gross energy expenditure of 3.2 (SD 0.9) MJ (exercise). On day 2 of both trials, subjects reported to the laboratory after a 12 h fast for an oral fat tolerance test (OFTT). Blood samples were obtained via a venous cannula in the fasted state and for 8 h after consuming a mixed high-fat meal (per kg body mass: 1.32 g fat, 1.36 g carbohydrate, 0.3 g protein and 76 kJ energy). Only water was consumed during the observation period. Food intake was standardized for the 2 d before each OFTT.

CM (sf ~ >400) and VLDL (sf ~ 20-400) fractions were isolated from plasma by sequential flotation in an ultracentrifuge. TAG concentrations in plasma and the CM, VLDL and infranatant fractions were determined by an enzymic colorimetric method. The total and fractional TAG responses were quantified as the areas under the respective TAG concentration *v.* time curves. The data were skewed, so statistical analysis (paired *t* tests) was carried out on log-transformed data. Results are presented in the Table as geometric mean (G-mean) and range.

		Fasting TAG concentration (mmol/l)	Area under TAG concentration *v.* time curve (mmol/l.8h)		
			Total TAG	CM TAG	VLDL TAG
Control	G-mean	1.09	15.19	2.57	7.71
	Range	0.62-3.88	8.38-53.53	1.17-13.35	2.98-34.73
Exercise	G-mean	0.85**	11.71**	1.97**	5.03**
	Range	0.44-3.60	6.32-56.23	0.93-16.21	1.66-34.54

Mean values were significantly different from control trial: $^{**}p < 0.01$

In eleven of the twelve subjects, areas under the total, CM and VLDL TAG concentration *v.* time curves were lower in the exercise trial. In this subject group, the exercise-induced attenuation to postprandial lipaemia was predominantly attributable to a lower postprandial VLDL TAG response, although the CM fraction was also reduced by exercise.

This research was supported by the British Heart Foundation.

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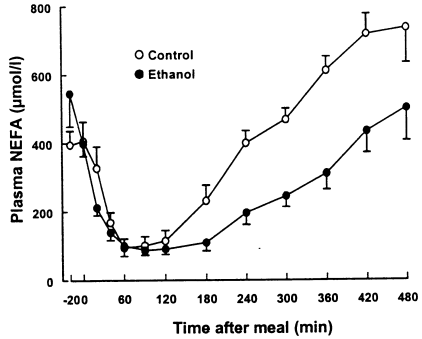
Potentiation of postprandial lipaemia by ethanol. By GUY REID, MICHELLE GRADY, BARBARA A. FIELDING, SANDY M. HUMPHREYS, KEVIN EVANS and KEITH N. FRAYN, *Oxford Lipid Metabolism Group, Radcliffe Infirmary, Oxford OX2 6HE*

Postprandial lipaemia is recognized as a risk marker for atherogenesis (Patsch *et al.* 1992). Moderate ethanol consumption is associated with reduced rates of CHD (Gordon *et al.* 1983) and yet ethanol potentiates postprandial lipaemia, by mechanisms which are not fully understood. We have studied this by giving subjects a meal enriched in palmitoleic acid (POA; 16:1 *cis n*-7) and tracing it into the triacylglycerol- (TG)-rich lipoproteins and non-esterified fatty acids (NEFA). Seven subjects fasted overnight and samples were taken from an arterialized vein before and for 8 h after a meal containing 51 g fat from macadamia nuts, 82 g carbohydrate and 47.5 g ethanol, or a control study without ethanol. Lipoprotein fractions were separated by cumulative flotation and specific fatty acids were measured in plasma TG, in TG-rich lipoproteins and in NEFA by GC. The postprandial plasma TG concentration was markedly elevated by ethanol (peak concentrations, µmol/l: control, 1129 (SE 121); ethanol, 1751 (SE 197), $P<0.05$), with particular elevation in the Sf>400 (chylomicron) and Sf 60-400 (VLDL1) fractions. There were no significant effects of ethanol on particle size, as measured by the TG : phospholipid ratio, within the Sf>400, Sf 60-400 or Sf 20-60 (VLDL2) lipoprotein fractions. Plasma NEFA concentrations fell similarly in the postprandial period in both studies, but the later rise was markedly suppressed by ethanol (Fig.).



The proportions of POA in NEFA were similar in ethanol and control studies, suggesting no specific suppression of NEFA generation from plasma TG, or effect on endogenous lipolysis. The increase in TG concentration in the Sf 60-400 fraction, together with our previous observation of elevated TG concentrations following ethanol alone (Frayn *et al.* 1990) might suggest a primary effect on stimulation of the secretion of large VLDL particles which then compete with chylomicron particles for clearance by lipoprotein lipase. The later depression of plasma NEFA concentrations could reflect increased uptake by the liver for TG synthesis, since the results with POA did not suggest an effect on peripheral lipolysis.

Financial support from the Portman Group is gratefully acknowledged.

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The metabolic response to feeding in weight-losing patients with advanced pancreatic cancer. By MATTHEW D. BARBER, JAMES A. ROSS and KENNETH C.H. FEARON, *University Department of Surgery, Royal Infirmary of Edinburgh, Edinburgh EH3 9YW*

Increased energy expenditure and inefficient use of nutrients have been suggested to contribute to the inexorable weight loss which contributes to morbidity and mortality in many patients with advanced cancer. We examined this hypothesis in nineteen weight-losing, non-diabetic patients with unresectable pancreatic adenocarcinoma and six healthy, weight-stable controls. Subjects attended after an overnight fast. After measurement of resting energy expenditure by indirect calorimetry (Deltatrac, Datex) subjects received four hourly meals of a liquid feed (providing 48 % of energy as carbohydrate, 39 % as fat and 13 % as protein (Fortisip, Nutricia)), each meal providing a twelfth of the estimated total daily energy requirement. Energy expenditure was measured every 40 min and serum insulin level was measured every 30 min over the four h feeding period. Substrate oxidation was calculated using the equations described by Consolazio*et al.* (1963). Serum insulin concentrations were measured by radioimmunoassay. Body composition was estimated by bioimpedence analysis.

	REE (kJ/kg lean body mass)	Change in AUC of energy expenditure (%)*	Baseline carbohydrate oxidation (mg/min/kg)	Carbohydrate oxidation at 120 mins (mg/min/kg)	Baseline fat oxidation (mg/min/kg)	Fat oxidation at 120 mins (mg/min/kg)
Cancer patients	141 (118-149)	7.3 (3.3-8.2)	0.52 (0-1.08)	1.32 (0.85-1.93)	1.21 (0.95-1.40)	1.07 (0.68-1.29)
Healthy controls	123 (122-125)	11.2 (9.0-11.1)	0.92 (0.54-1.21)	1.90 (1.38-2.29)	0.76 (0.60-0.90)	0.65 (0.53-0.73)
P value	0.27	0.005	0.21	0.19	0.0051	0.062

AUC, area under the curve; REE, resting energy expenditure.

* Compared with baseline value.

Characteristics of patients and controls (median and interquartile range) are shown in the Table. Patients were significantly lighter than controls with a median weight of 55.5 (49.9-70.3) kg *v.* 77.2 (70.3-96) kg, P=0.0003. REE was not significantly different between patients and controls. As expected, changes in insulin and glucose concentrations in cancer patients over the feeding period suggested relative insulin resistance. The percentage change in the AUC of energy expenditure was significantly lower in patients than controls. There was no significant difference in carbohydrate oxidation between patients and controls when either fasted or fed. Baseline fat oxidation was significantly greater in patients than controls but in the fed state levels did not differ significantly.

Thus, it would appear that weight-losing patients with advanced pancreatic cancer do not have any increase in the metabolic cost of feeding to account for their catabolism but in fact show a reduction appropriate to their wasted state. Cancer patients oxidize significantly more fat while fasting but have similar levels in the fed state, while carbohydrate oxidation is similar in both groups while fasting and fed.

Further studies of the metabolic changes responsible for cachexia and the mediators responsible for these changes in cancer are required.

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Dietary supplementation with eicosapentaenoic acid slows human pancreatic cancer growth in SCID mice. By MATTHEW D. BARBER, KENNETH C.H. FEARON and JAMES A. ROSS, *University Department of Surgery, Royal Infirmary of Edinburgh, Edinburgh EH3 9YW*

Eicosapentaenoic acid (EPA) is a normal constituent of the diet which has been suggested to have immunomodulatory, antineoplastic and anticachectic effects at a dose of 10 to 100 times the normal intake. We have previously shown that EPA will inhibit the growth of human pancreatic cancer cell lines *in vitro* (Falconer *et al.* 1994). The present study aimed to assess the effect of dietary EPA upon the growth of a human pancreatic cancer cell line in an immunocompromised mouse model.

Pieces of tumour derived from the MIAPaCa-2 human pancreatic cancer cell line were transplanted subcutaneously on the flank of 5-6-week-old female SCID mice. From the day after implantation mice were fed on a fat-free diet to which was added oil to make up 50 g/kg of the final diet weight using either maize oil or 95 % pure EPA as free acid or a novel diester form (40 g/kg, plus 10 g maizeoil/kg). Feed was prepared weekly and changed daily; 5 g/mouse per d was supplied initially. Oils were stored under N_2 with no additional antioxidants. Mice were killed before the tumour burden became excessive at about 3 weeks. Matched groups of animals without tumours acted as further controls. Organs were examined histologically for metastases and tissues were subjected to fatty acid analysis by gas chromatography. Paired groups of at least twelve animals on each diet were studied.

Mice fed on the diet enriched with EPA free acid had significantly lighter tumours than control animals (median 3.0 (interquartile range (IQR) 2.3-4.0) g *v.* 4.9 (3.4-7.5) g, P=0.023, Mann-Whitney U test). As mice fed on EPA free acid ate significantly less food than controls (2.25 g/d *v.* 3.05 g/d, p=0.021), the experiment was repeated supplying matched amounts of food (2.93 g/d *v.* 2.77 g/d, P =0.37). Again tumours were significantly lighter in EPA free acid-fed mice (2.8 (IQR 1.4-4.8) g *v.* 4.5 (3.4-6.0) g, P =0.044) suggesting that the tumour growth reduction was due to EPA and not diet restriction.

Due to the relatively poor tolerance to the EPA free acid preparation a novel diester preparation of EPA with propan-1,3-diol was used to prepare the feed. This was well tolerated with a daily consumption of 3.58 g *v.* 3.42 g (P =0.96). Tumours were again lighter in animals fed on the EPA-enriched diet (3.7 (2.7-4.7) g *v.* 5.0 (3.4-6.6) g, P =0.035).

There was no evidence of metastases in the organs examined in mice bearing the MIAPaCa-2 tumour.

Fatty acid analysis revealed substantial incorporation of EPA into the phospholipids of tissues of mice fed on the EPA-enriched diets. There were also large increases in the n-3 fatty acids docosapentaenoic acid and docosahexaenoic acid. These changes were accompanied by substantial falls in the proportions of the n-6 fatty acids, linoleic and arachidonic acid within tissue phospholipids.

We conclude that 6-8 g EPA/kg diet will slow the growth of a human tumour in a mouse xenograft model. While tolerance of the EPA free acid was limited (perhaps due to low pH), a novel diester preparation was well tolerated. The potential of EPA as a non-toxic anti-cancer agent and the importance of the balance between n-6 and n-3 fatty acids in the diet deserve further study in human neoplastic disease.

Falconer JS, Ross JA, Fearon KCH, Hawkins RA, O'Riordain MG & Carter DC (1994) *British Journal of Cancer* **69**, 826-832.

The level of protein in the diet of pregnant rats affects lymphocyte proliferation and natural killer cell activity in the offspring at weaning. By P.C. CALDER and P. YAQOOB*, *Institute of Human Nutrition, University of Southampton, Bassett Crescent East, Southampton SO16 7PX*

The risk of asthma and of mortality from infectious diseases has been related to indices of maternal nutrition (Godfrey *et al.* 1994; Fergusson *et al.* 1997; Moore *et al.* 1997), suggesting nutritional programming of the immune system in foetal life (see Langley-Evans, 1997; Moore 1998 for reviews). However, little is known about the effect of moderate dietary restriction in pregnancy on immune competence of the offspring. This was investigated in the current study.

Female Wistar rats were assigned to receive isoenergetic diets containing either 90 or 180 g protein/kg (high N casein) from the day they became pregnant. When they gave birth the litters were reduced in size to eight pups and the dams were transferred to standard laboratory chow, on which they were maintained throughout lactation. At 4 weeks after birth, the usual time of weaning, the offspring were killed and the spleens and thymuses removed. Lymphocytes were prepared by standard procedures (see Yaqoob *et al.* 1994*a*). Lymphocyte proliferation was measured as [^{3}H]thymidine incorporation in response to the T-cell mitogen concanavalin A (Con A; 5 μg/ml) or the B-cell mitogen *Eschericia coli* lipopolysaccharide (LPS; 5 μg/ml) and is expressed as stimulation index (see Yaqoob *et al.* 1994*a*). Natural killer (NK) cell activity of spleen lymphocytes towards the YAC-1 cell line was determined as described elsewhere (Yaqoob *et al.* 1994*b*).

Pups .... Maternal dietary protein (g/kg)	Spleen weight (mg)		Thymus weight (mg)		Spleen lymphocyte response to Con A		Spleen lymphocyte response to LPS		Thymus lymphocyte response to Con A		Spleen NK cell activity (% cytolysis)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
90	387	16	458	45	2.5	0.7	0.72	0.05	143	11	18.7	3.2
180	485*	30	507	30	37.7*	9.7	3.57*	0.22	360*	48	35.0*	5.5

Data are mean values with their standard errors for four offspring from each of four dams fed on each diet.
Mean values were significantly different from 90 g/kg diet: *$P < 0.05$.

Spleen weight, proliferation of spleen and thymus lymphocytes in response to Con A or LPS and spleen NK cell activity were all significantly higher in the offspring of dams which received the 180 g protein/kg diet during preganancy.

This study indicates that the macronutrient status of the diet consumed during pregnancy significantly alters immune function in the offspring at weaning. This suggests that some aspects of immune function are programmed *in utero* by factors related to the diet of the mother. The effects of the nutrients and other factors received during suckling and of the developmental changes in the immune system which occur post-partum appear unable to overcome the impact of the diet received *in utero*. We did not examine whether the impact of the prenatal diet is retained beyond weaning, or whether the changes in immune function observed at weaning alter susceptibility to infection. However, the acute phase response in early adult life of the offspring of dams fed on the low-protein diet is blunted (Langley *et al.* 1994) suggesting that the effect of maternal nutrition extends beyond weaning and may alter host resistance.

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Variability in the composition of fat-free mass in children aged 8 - 12 years. By J.C.K. WELLS[1], N.J. FULLER[2], O. DEWIT[2], M.S. FEWTRELL[1], M. ELIA[2] and T.J. COLE[2], *[1]Childhood Nutrition Research Centre, Institute of Child Health, London WC1N 1EH and [2]MRC Dunn Clinical Nutrition Centre, Cambridge CB2 2DH*

Changes in the composition of fat-free mass (FFM) that occur throughout childhood have been summarized in the 'reference child' (Fomon *et al.* 1982) from multiple data sets which did not consider inter-individual differences. We have used a four component (4C) model of body composition in thirty children aged 8 - 12 years with the following aims: (1) to compare the density and hydration of FFM with adult values and (2) to assess biological variability in the composition of FFM. Total body mineral was measured by dual-energy X-ray absorptiometry, total body water (TBW) by deuterium, and fat mass (FM) by underwater weighing using the 4C model as described previously (Fuller *et al.* 1992). FFM was calculated as weight minus FM. Density and hydration of FFM were compared with adult values obtained previously using the same model (Fuller *et al.* 1992). Methodological error was assessed by propagation of error, with values for measurement precision being obtained by duplicate measurements. Biological variability (Vb) was then distinguished from total variability (Vt) and methodological variability (Vm) using the following equation: $Vt^2 = Vm^2 + Vb^2$.

Precision values were 0.19 litres for body volume; 0.19 litres for TBW; 0.01 kg for body weight; and 0.01 kg (assumed) for body mineral mass. Mean FFM hydration was 75.3 (SD 2.2) %, FFM density was 1.0864 (SD 0.0013) kg/l and the mineral:protein value of FFM was 0.208 (SD 0.031); these values were all significantly different from adult values of 73.3 (SD 2.1) % ($P<0.02$) (Fuller *et al.* 1992), 1.1015 (SD 0.0073) kg/l ($P<0.001$) (Fuller *et al.* 1992) and 0.262 ($P<0.001$) (Brozek *et al.* 1963) respectively.

	Mean	Vt	Vm	Vb
Water content of FFM (%)	75.3	2.2	1.5	1.6
Mineral content of FFM (%)	4.02	0.37	0.09	0.36
Protein content of FFM (%)	19.6	2.2	1.6	1.5
Mineral:protein ratio in FFM	0.208	0.031	0.021	0.023
Density of FFM (kg/l)	1.0864	0.0074	0.0046	0.0058

Values for Vt, Vm and Vb expressed as standard deviations in the same units as Mean

Our data, representing the first measured values of the density of FFM in children, show significant differences from adults in the density, hydration and mineral:protein value of the FFM. Up to half of the total variability in the composition of FFM can be attributed to methodological error. However, the water, mineral and protein content of FFM all vary between individuals, and more than half the variability in the density of FFM can be attributed to biological factors.

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Energy content of abnormal losses from intensive care patients. By CLARE REID,[1,2,3] KATH SHIPLEY[2], G. JENNINGS[4], M. ELIA[4] and I.T. CAMPBELL[2], *[1]Intensive Care Unit, Hope Hospital, Manchester M6 8HD, [2]Department. of Anaesthesia, [3]North Western Injury Research Centre, University of Manchester, Manchester M13 9PT and [4]Dunn Nutrition Laboratory, Cambridge CB4 1XJ*

Measurement of energy expenditure to determine a patient's energy requirements is becoming a more common procedure in critical illness. However, this procedure does not take into account the energy content of abnormal losses, which commonly occur in such patients (e.g. nasogastric aspirate, haemofiltrate and wound drainage). Since information on the energy content of these losses is lacking, we undertook a preliminary study to determine the energy loss in 24 h samples collected over 3-5 d from five different critically ill patients. The following samples were freeze-dried and their energy content measured by bomb calorimetry: nasogastric aspirate (n = 1; 4 d), haemofiltrate (n = 1; 3 d) fistula loss (n = 2; 6 d and 4 d) and abdominal wound drainage (n = 1; 5 d).

		24 h volume (ml)	Energy value freeze dried (kJ/g)	Energy value original substance (kJ/ml)	Energy loss/24 h (kJ)
Nasogastric aspirate (4 d)	Median	175	17.3	0.710	109
	Range	50-250	14.5-20.2	0.585-1.09	33.4-267
Haemofiltrate (3 d)		34,700	3.76	0.025	874
		33,500-34,700	3.22-3.88	0.025-0.029	840-1015
Fistula Patient 1: 6 d		627	16.5	0.656	397
		398-1000	12.3-20.2	0.552-0.961	275-961
Fistula Patient 2: 4 d		751	16.9	0.840	760
		699-1914	14.5-19.2	0.489-1.14	539-936
Abdominal wound drainage (5 d)		702	20.2	0.878	660
		699-800	18.2-20.5	0.828-1.64	581-1150

The Table shows that the energy density of the wound-intestinal effluents was typically 12-20 kJ freeze dried material (0.62 - 0.88 kJ/ml original material), except for the haemofiltrate which was 3.76 kJ/g freeze dried material (0.025 kJ/ml original fluid). The daily energy loss ranged from 33-1150 kJ, i.e. up to 14-15 % of average 24 h energy expenditure (Green *et al.* 1995). It is concluded that although energy losses from wound/intestinal effluents are usually ignored, they can have a substantial influence on energy balance in some critically ill patients.

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Green C, Campbell IT, McClelland P, Ahmed M, Hutton JL, Helliwell T, Wilkes RG, Gilbertson AA, Bone JM (1995). *Nutrition* **11**, 739-746.

Age related changes in intestinal permeability in a rural West African population. *By* D.I. Campbell [1], P. G. Lunn [2], L. Umar [1]and M. Elia [2,1] *Dunn Nutrition Unit, Keneba, PO Box 273, Banjul, The Gambia, [2] Dunn Nutrition Unit, Cambridge CB4 1XJ*

The poor growth of Gambian infants is strongly associated with a small-bowel enteropathy and may be the result of it (Lunn & Northrop-Clewes et al. 1991). If a causal relationship between the enteropathy and growth faltering exists, an improvement in intestinal integrity would be expected after 5 years of age, when a slow rate of catch up begins to occur. The aim of the presrent cross-sectional study was twofold: to investigate (1) whether small-intestinal integrity as measured by a dual sugar permeability test improves after 5 years of age and (2) whether it is related to growth performance in these children.

A lactulose:mannitol intestinal permeability test (mannitol passively absorbed, lactulose absorbed from areas of diseased bowel ratio of L:M recovery measures small bowel permeability) was performed in 162 healthy subjects , aged 2-60 years, living in three villages in West Kiang region of The Gambia (Keneba, Manduar and Kanton Kunda). The dose of permeability markers varied with age, but the composition of the solution was constant at 2 g lactulose and 0.5 g mannitol per 10 ml water.

Age group (years)	n	L:M		Recovery of mannitol (%)		Recovery of lactulose (%)	
		Mean	SD	Mean	SD	Mean	SD
2-5	25	0.37[a]	0.15	5.0	2.0	0.44[a]	0.19
5-10	31	0.25[b]	0.12	6.0	2.0	0.36[a,b]	0.17
10-15	27	0.18[b]	0.12	6.0	4.8	0.21[b]	0.11
15-20	29	0.20[b]	0.13	5.0	3.6	0.22[b]	0.18
20-30	24	0.13[b]	0.08	4.7	2.5	0.16[b]	0.13
30+	26	0.11[b]	0.07	6.0	2.0	0.16[b]	0.13

a,b Mean values not sharing a common superscript letter were significantly different, $P<0.005$

*Significant difference between 2-5 years and all other groups p< 0.004 (2 tail)

‡Significant difference between 2-5 years and all groups above 10 years 0<0.0001

The lactulose:mannitol (L:M) value was abnormally high compared with UK normal values (<0.1 in adults and children). It fell progressively with age, from a mean value of 0.37 (SD0.15) in under 5 year olds to 0.13 (SD 0.07) in subjects greater than 20 years. The improvement was due to a steady fall in urinary lactulose recovery from 0.44 (SD 0.19) % at 2 years to 0.16 (SD 0.13) %, above the age of 20 years (UK value <0.3 %). Urinary recovery of mannitol however showed no improvement with age, the mean value in over 20-year-old subjects being 6.0 (SD 2.0) %, or twofold lower than the normal UK range (11-15 %).

Over the whole age range, intestinal permeability was related to anthropometric measurements. Both weight- and height-for-age z-scores (UK 1990 Standards) were related to the L:M ratio, r =0.21, P = 0.007 and r =0.26, P =0.001 respectively.

This study in Gambians demonstrates (1) abnormally high intestinal permeability which improves after 5 years of age and (2) that the relationship between intestinal permeability and growth exists from infancy to adulthood. The results are consistent but do not prove a causal relationship between enteropathy and growth failure.

Lunn, P G, Northrop-Clewes C A, Downes, R M (1991).*Lancet* **338**, 907-910.

The value of modified sham feeding as a model to study pre-absorptive changes in appetite sensations. By REBECCA J. STRATTON, ANNE NUGENT and MARINOS ELIA, *MRC Dunn Clinical Nutrition Centre, Hills Road, Cambridge CB2 2DH*

The modified sham feeding (MSF) model has been used in human subjects to study the pre-absorptive effects of food ingestion on appetite sensations (LeBlanc & Soucy, 1996; Stratton *et al.* 1998,). Inherent in the use of this model is the assumption that during the process of tasting, chewing and spitting out food, no particles of nutritive material are swallowed. However, this assumption has not been verified. The aim of the present study was to test the hypothesis that during MSF of nutritive material, food particles can be swallowed and affect appetite sensations.

After an overnight fast, eleven healthy, weight-stable men (age 41 (SD 13) years, BMI 22.1 (SD 1.6) kg/m^2), who had been maintaining their normal eating habits over the previous few days, were given a sandwich test meal to taste, chew and spit out (MSF) over 10 min (150 g, 1.5 MJ, 40 % energy from fat, 45 % carbohydrate, 15 % protein). The expectorated food material and the 150 ml water that was used to rinse the mouth during MSF were collected in separate covered containers and freeze-dried until constant weight was achieved. The weights of the freeze-dried expectorated remains were compared with the mean weight of four freeze dried sample sandwiches. Appetite sensations (hunger, desire to eat, fullness) were assessed using 100 mm visual analogue scales (e.g. 'not at all hungry' (score 0) to 'as hungry as I have ever felt' (score 100)) before the test meal, every 2.5 min during the test meal, and thereafter, every 5 min for 0.5 h and then at 15 min intervals up to 85 min. The test period was immediately followed by an *ad libitum* lunch (each food item 550 kJ/100 g, 30 % energy from fat, 47 % from carbohydrate, 13 % from protein) from which subsequent energy intake was calculated. The dry weight of the sample sandwiches (*n* 4) was 73.3 (SD 1.6) g, that of the expectorated nutritive material was 66.9 (SD 6.9) g, and the calculated mean amount of swallowed material was 6.4 (range 0-16.35) g, equivalent to 0-22 % of intake.

	Swallowed < 6.4 g (*n* 6)		Swallowed > 6.4 g (*n* 5)	
	Mean	SD	Mean	SD
Change in hunger	+8	13	-11*	17
Change in desire to eat	+6	17	-4*	14
Change in fullness	+2	12	+14*	22

Mean values were significantly different from those for the < 6.4g group, *P<0.005 (independent t test)

The changes in appetite sensations over the test period (0-85 min) in those that swallowed > 6.4 g (*n* 5) were significantly different from those that swallowed < 6.4 g (see Table). Furthermore, those that swallowed > 6.4 g showed a significant decrease in hunger over the test period (P < 0.005) and a trend to increasing fullness (P < 0.07), but no such changes were observed in those that swallowed < 6.4 g (repeated measures ANOVA). Subsequent energy intake at lunch did not differ between the two groups (6442 (SD 2036) KJ *v.* 7208 (SD 2411) KJ, independent t test).

This study in healthy subjects confirms our hypothesis that during the MSF of nutritive material, food particles are swallowed, and strongly suggests that swallowed nutritive material affects subsequent appetite sensations. Furthermore, the study shows that in some individuals MSF is not a suitable model for studying the pre-absorptive effects of food ingestion (the cephalic phase response).

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Stratton RJ, Stubbs RJ & Elia M (1998) *Proceedings of the Nutrition Society* (In the Press).

The incidence of malnutrition in medical patients admitted to a hospital in south London. By E. WEEKES, *Department of Nutrition and Dietetics, St Thomas' Hospital, London SE1 7EH*

The reported incidence of malnutrition in hospitalized patients varies from approximately 10 to 60 %. This variation could in part be due to differences in the anthropometric criteria used to define malnutrition and also to limited consideration of the effects of fluid retention (oedema and/or ascites). Criteria for definition of malnutrition have included BMI of < 18, < 19 or < 20 kg/m^2, and triceps skinfold thickness (TSF) or mid-arm muscle circumference (MAMC) <5th, <10th or < 15th centiles. In some studies, an unintentional, recent weight loss of > 10 % body weight has also been used. The aims of the present study were to assess the incidence of malnutrition in medical patients admitted to a large teaching hospital in a socially-deprived area of south London (STH), to assess how the incidence of malnutrition varies according to the anthropometric criteria used, and to document the frequency of fluid retention.

A total of 250 consecutive patients admitted to the general medical wards were identified. Of these, 192 patients (77 %) were assessed within 3 days of admission and fifty-eight (23 %) were not. Twenty-six (10 %) died or were discharged before assessment and thirty-two (13 %) were unable or unwilling to consent. Mean age was 58.1 (range 17 - 94) years. Patients were weighed on bathroom or chair scales as appropriate. Six patients (3 %) were not weighed due to their clinical condition. A history of weight change in the previous 6 months was obtained from either the patient or medical notes in all but twelve (6 %) patients. Height was measured using a Leicester portable stadiometer (*n* 172) or estimated from a demi-span measurement (*n* 20). Mid-arm circumference and TSF were measured in all patients according to published techniques. Mean weight was 68.0 (range 36.4 - 129.6) kg and mean BMI was 23.7 (range 14.2 - 43.3) kg/m^2.

BMI (kg/m^2) (*n* 186)	MAMC centile (*n* 192)	TSF centile (*n* 192)	> 10% weight loss (*n* 31)
< 20.0 41 (22%)	< 15th* 59 (31%)	31 (16%)	BMI > 20 kg/m^2 20 (11%)
< 19.0 27 (14.5%)	< 10th† 46 (24%)	22 (12%)	
< 18.0 16 (9%)	< 5th† 32 (17%)	15 (8%)	BMI < 20 kg/m^2 11 (6%)

* Frisancho (1981); † Bishop *et al.* (1981)

These values are likely to be underestimates. Of the fifty-eight patients who were not assessed for practical reasons, in twenty-five (10 %) this was due to the severity of their clinical condition. Furthermore, fluid retention was detected in thirty-two (17 %) patients. The presence of oedema and/or ascites can mask weight loss thus affecting anthropometric measurements.

In this study the incidence of undernutrition varied more than threefold (9 to 31 %) depending on the anthropometric criteria used to define the condition. It is also suggested that failure to recognize fluid retention may contribute to an underestimation in the incidence of malnutrition. Other factors likely to contribute include differences in techniques used to assess nutritional status, the use of reference standards that are not population-specific and demographic differences. Universal criteria for the definition of malnutrition need to be established before these differences can be investigated further.

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Frisancho AR (1981) *American Journal of Clinical Nutrition* **34**, 2540-2545.

Growth of paediatric and adult home enteral tube feeding between 1986 and 1998 in the Cambridge health district. By ODILE DEWIT[1,2], SYLVIA M. COTTEE[2] and NICOLA McLEAN[3], [1]*MRC Dunn Clinical Nutrition Centre, Cambridge CB2 2DH,* [2]*Nutrition Team, and* [3]*Department of Nutrition and Dietetics, Addenbrooke's NHS Trust, Cambridge CB2 2QQ*

The British Artificial Nutrition Survey was established in 1996 and estimated a growth in home enteral tube feeding (HETF) of about 25 % in the UK between 1996 and 1997 (BANS Working Party, 1998). Each health authority requires local data on growth rate to allocate specific HETF resources. Indications for HETF, outcomes, use of gastrostomy and attitudes to artificial nutrition support are different for paediatric and adult patients. The aim of the present study was to compare growth of paediatric and adult HETF between 1986 and 1998 in the Cambridge health district.

Information was established prospectively over 12 years (1986-1998) for patients receiving HETF (whether full nutrition support or supplemental to oral intake, via nasogastric, gastrostomy or jejunostomy tubes, at home, in nursing homes, or residential homes/schools) within the Cambridge health district. Neonatal patients were not included. Thirty-six paediatric patients were female and thirty-six were male; median age was 5.8 (range 0.1-15.9) years. Fifty-one adult patients were female and seventy-three were male; median age was 59.7 (range 16.5-89.2) years. The most common indications in the paediatric patients were cerebral palsy (*n* 25), congenital malformation or handicap (*n* 10), and haematology/oncology (*n* 9). In the adult patients, the most common indications were cerebrovascular accident (*n* 32), cancer of the oesophagus/oropharynx (*n* 13), motor neurone disease (*n* 10), multiple sclerosis (*n* 10), cerebral trauma (*n* 10), cerebral palsy (*n* 10), and Crohn's disease (*n* 6). Fifty-five (76.4 %) paediatric patients started HETF via a nasogastric tube, of which sixteen had a gastrostomy sited secondarily. Seventeen (23.6 %) started HETF via a gastrostomy. Thirty adults (24.2 %) started HETF via a nasogastric tube (of which only one had a gastrostomy sited secondarily), eighty-seven (70.2 %) started via a gastrostomy, and seven via a jejunostomy tube. Median duration of feeding was 10.3 (25th-75th centiles 2.1-30.6; range 0.1-115) months for the paediatric group, and 4.4 (25th -75th centiles 1.2-16.5; range 0.2-78.9) months for the adult group. The number of patient-days per year was established as the sum of the total number of days of HETF for all patients in the year. The point-prevalence (number of patients on HETF on any one day of the year) was this number divided by 365 (days per year). Results are expressed per year ending 31st March (i.e. year 1st April-31st March).

The number of patient-days increased steadily between 1987 and 1994 at average annual rates of 28.4 % and 52.0 % for paediatric and adult HETF respectively. Then, between 1994 and 1998, the average annual growth rates were 29.1 % and 17.1 % for paediatric and adult HETF respectively. Growth in the last 3 years (1996-1998) was markedly slower for adult HETF than for paediatric HETF: the average annual growth rates were 25.5 % and 6.5 % for paediatric and adult HETF respectively.

	Paediatric HETF							Adult HETF						
Year	1987	1991	1994	1995	1996	1997	1998	1987	1991	1994	1995	1996	1997	1998
Point-prevalence (*n*)	1.7	3.0	9.6	12.4	17.0	22.6	26.7	0.8	4.8	14.6	22.2	24.2	22.5	27.5
Patient-days (*n*)	612	1096	3514	4511	6190	8263	9749	284	1735	5330	8110	8846	8211	10041
Annual growth rate (%)				28.4	37.2	33.5	18.0				52.2	9.1	-7.2	22.3

The present study shows that prescription of paediatric and adult HETF has increased dramatically in the last 12 years, but with two different growth patterns. The increase in the late 1980s and early 1990s was more marked for adult than for paediatric HETF. There has been a much less rapid growth over the last 3 years for adult HETF, while it has only started to slow down for paediatric HETF in the last year. Continuing audit of local HETF growth will help to ensure a health service provision appropriate for the needs of both children and adults.

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Health-related quality of life and nutritional outcomes after percutaneous endoscopic gastrostomy (PEG): A prospective study. By ELAINE BANNERMAN[1], JOHN PENDLEBURY[1], FIONA PHILLIPS[2] and SUBRATA GHOSH[1], *Nutrition Support Team,* [1]*Gastrointestinal Unit and* [2]*Department of Dietetics and Nutrition, Western General Hospital, Crewe Road, Edinburgh EH4 2XU*

We have previously reported on the health-related quality-of-life (HRQoL) of patients after PEG placement in a cross-sectional cohort (Bannerman *et al.* 1998). A prospective study of patients referred for gastrostomy over a 1-year period has been carried out to determine whether patients showed changes in HRQoL and nutritional status after PEG placement at 1 and 6 months follow-up.

HRQoL was assessed using the Short Form-36 (SF-36) (Jenkinson *et al.* 1993) and the Hospital Anxiety and Depression scale (HAD) (Zigmond & Snaith, 1983). In addition, ten questions were asked about the impact of PEG on patients HRQoL (PEGQu). Nutritional status (protein-energy malnutrition, PEM) was assessed using upper-arm anthropometry and interpreted using arm-muscle circumference (AMC) and/ or triceps skinfold thickness (TSF) <10th centile of age & sex-specific reference data (Bishop *et al.* 1981; Burr & Phillips, 1984).

Fifty-four patients agreed to participate (thirty-seven males: seventeen females) age range 19 - 89 years. Thirty-seven patients (70 %) had neurogenic dysphagia: eleven (21 %) head injury, fourteen (26 %) stroke, twelve (23 %) had bulbar palsy due to motor-neurone disease (MND) or multiple sclerosis (MS). Eight patients (16 %) had oesophageal or head and neck malignancy, two patients had cystic fibrosis (CF) and required supplementary nutrition. At time of PEG placement, sixteen patients (38 %) had an AMC &/or TSF <10th centile and thus were considered to be malnourished.

In terms of patient outcome at 1 month forty-five (83 %) patients were still living, of these twenty-three patients remained in hospital (long-stay, rehabilitation, acute or respite care), two were in a nursing home and twenty patients were at home. Forty-one patients (76 %) were still receiving nutritional support through the PEG. Of the patients who had resumed oral intake two had head injuries, one had a stroke and one had oesophageal malignancy. At 6 months twenty-four patients (56 %) were still living and available for follow-up, eleven remained in hospital, seven were resident in a nursing home and eleven were at home. At 1 month follow-up nutritional outcomes of patients with head injury, stroke and neurological degenerative diseases were mixed; fourteen patients (47 %) showed improvement whilst fifteen patients (50 %) showed deterioration, as indicated by a depleted corrected arm-muscle area (CAMA). All patients with malignancies of the oesophagus or head and neck regions showed deterioration in nutritional status 1 month after they received the PEG. At 6 months follow-up no patients with carcinoma of the oesophagus were living, two patients with cancer of head or neck (still living) showed further deterioration in their nutritional status. Conversely, all patients who were still living after stroke showed improved nutritional status (increased CAMA).

In terms of HRQoL, there was little change in patients SF-36 scores 1 month after PEG placement. From the HAD scores (*n* 15) patients' psychological HRQoL scores were mixed; 44 % patients becoming more anxious or depressed, 42 % of patients becoming less anxious or depressed and 14 % showing no change. From the questions asked specifically about the PEG; at 1 month 73 % of patients (*n* 14) felt that they could cope with the PEG whilst 83 % (*n* 16) were happy and confident with the care that was required. At 6 months all patients (*n* 11) thought they could cope and were confident with the care of the PEG. However, nine out of the nineteen patients who could complete the PEGQu at 1 month (47 %) and eight of the eleven patients who completed the PEGQu at 6 months (73 %) thought that their involvement in social activities had not improved since they had received the PEG. However, in terms of the overall impact of PEG on HRQoL at 1 month, ten patients (53 %) thought that the PEG had had a positive impact, two patients felt that it had a negative impact. At 6 months no patient thought that PEG had had a negative effect on HRQoL, with eight patients (73 %) expressing a positive effect. These data have implications for patient selection for PEG placement.

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Hand-grip strength in cirrhosis: Its relationship to nutritional status and severity of liver disease. By ANGELA M. MADDEN and MARSHA Y. MORGAN, *Department of Medicine, Royal Free Hospital, London NW3 2QG*

The evaluation of muscle strength has been advocated as a measure of nutritional status (Klidjian *et al.* 1982). Its value in the assessment of nutritional status in patients with chronic liver disease has received only limited attention (Andersen *et al.* 1998). The aim of the present study was to determine the relationship between muscle strength and nutritional status in patients with cirrhosis while controlling for the potential confounding effects of the severity of the liver disease.

The population comprised 215 patients with cirrhosis (129 men, eighty-six women; mean age 51.0 (range 26-76) years). The severity of their liver disease was assessed using Pugh's modification of the Child's grading system where grade A represents well-compensated disease and grade C severely decompensated disease (Pugh *et al.* 1973). Global nutritional status was assessed using a reproducible method previously validated in this population (Madden *et al.* 1997). Hand-grip strength was measured in the non-dominant hand using a Takei Instrument (Tokyo, Japan) and the results compared with reference data (Webb *et al.* 1989).

Median values of relative hand-grip strength decreased significantly with increasing impairment of nutritional status ($P<0.0001$):

	Adequate nutrition (*n* 92; 43 %)		Moderately malnourished (*n* 85; 39 %)		Severely malnourished (*n* 38; 18 %)	
	Median	Range	Median	Range	Median	Range
Hand-grip strength (%)	72	25-124	57	17-109	51	31-96

Median values of hand-grip strength also decreased significantly with increasing severity of liver disease ($P<0.001$):

	Child's grade					
	A (*n* 65; 30 %)		B (*n* 63; 29 %)		C (*n* 87; 41 %)	
	Median	Range	Median	Range	Median	Range
Hand-grip strength (%)	72	25-121	63	33-109	55	17-124

Both variables were significantly and independently associated with relative hand-grip strength on two-way ANOVA, although the relationship was stronger with nutritional status ($P<0.0001$) than with severity of liver disease ($P<0.05$).

Relative hand-grip strength provides a clinically useful method of assessing nutritional status in patients with chronic liver disease irrespective of the degree of hepatic decompensation.

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Energy balance in chronic haemodialysis. By D. FRASER[1], MARIE KEEGAN[2], MICHELLE HARVIE[2], M.C. VENNING[1] and I.T. CAMPBELL[2], *[1]Department of Renal Medicine and [2]University Department of Anaesthesia, Withington Hospital, Manchester M20 2LR*

Malnutrition is common in haemodialysis patients; it is often said that haemodialysis is associated with an increased energy expenditure but the evidence is not entirely convincing (Ikizler & Hakin, 1996). We have measured energy expenditure before and during haemodialysis in patients on chronic haemodialysis and in normal volunteer controls over an equivalent period. Habitual dietary energy intake was also measured prospectively (by household measures) over 3 d. Patients were on a diet restricted in K, but there was no restriction on either protein or energy intake. High energy intakes in these patients are normally encouraged.

Ten patients and ten controls were studied. All had stable body weights over the preceding 6 months. Energy expenditure was measured by indirect calorimetry (GEM, Europa Scientific, Crewe) for 30 min before the start of haemodialysis and for the 4 h of dialysis, or equivalent time, in the controls. In all subjects measurements started between 08.00 hours and 09.00 hours following an overnight fast.

Table 1

		Age (years)	Height (m)	Weight (kg)	BMI (kg/m^2)	Body Fat %	Fat-free mass (kg)
Patients	Median	60.5	167	64.9	23.5	25.9	48.3
	Range	30-75	1.55-1.76	47.6-99.2	19-35	15.6-42.6	36.6-71.5
Controls	Median	50	167	65.4	22	30.0	43.3
	Range	22-71	1.59-1.78	50.0-80.8	19-30	19.5-35.9	34.8-59.7

Table 2

	Energy expenditure pre-dialysis (mJ/24h)		Energy expenditure during dialysis (mJ/24h)		Habitual Energy intake (mJ/24h)	
	Mean	SD	Mean	SD	Mean	SD
Patients	5.73	0.37	5.33	0.38	6.88***	1.20
Controls	5.73	0.34	5.52	0.36	10.07	2.25

Median value was significantly different from that for controls:*** $P<0.001$.

There was no difference between the two groups in age, height, weight or sex, or in percentage body fat calculated from skinfold measurements (Durnin & Womersley, 1974). There was no difference between the groups in energy expenditure either before or during haemodialysis or with the onset of dialysis but energy intake was significantly lower in the patients than in the controls (P<0.001).

It is concluded that energy expenditure in haemodialysis patients is not elevated but habitual energy intake is significantly lower than that of controls. A deficiency in energy intake is normally associated with an adaptive decrease in energy expenditure (Liebel *et al.* 1995), but this was not seen in the haemodialysis patients. The lower energy intake reported could represent a lower level of non-basal energy requirement (activity, dietary induced thermogenesis etc.) in these individuals, or a failure to adapt to the decreased intake.

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Circulating concentrations of vitamins D, C and thiamin in disabled patients on long-term enteral tube feeding. By ODILE DEWIT[1], H. FINCH[2], C. BALDWIN[1], A. SAYER[2], G JENNINGS[1], J. SHAW[1] and M. ELIA[1], [1]*MRC Dunn Clinical Nutrition Centre, Cambridge CB2 2DH, and* [2]*Royal Hospital for Neuro-disability, Putney, London SW15 3SW*

A variety of vitamin deficiencies have been described in patients on home enteral tube feeding, including deficiency of vitamins D, C and thiamin, in patients with a range of diseases, receiving different feeds. Possible reasons for deficiencies include loss of nutrient before to delivery of feed to the patient, poor absorption, and increased vitamin requirements in disease. The aim of the present study was to assess the frequency of deficiencies in vitamins D, C and thiamin in a group of neurologically disabled patients who were on long-term tube feeding, receiving feeds from the same manufacturer, and no oral intake.

Twenty-eight subjects (eighteen females, ten males) resident in the Royal Hospital for Neuro-disability, Putney, London, aged 20-74 (median 51.4) years, entered the study. They were wheelchair-bound and dependent on carers. They had been receiving cyclic nocturnal enteral tube feeding for 0.7-15.8 (median 6.2) years for swallowing difficulties resulting from neurological diseases (multiple sclerosis *n* 11, cerebral trauma *n* 8, cerebrovascular disease or hypoxic brain damage *n* 7, other *n* 2). Mean body weight was 63.4 (SD 8.7) kg (BMI 22.5 (SD 2.3) kg/m^2). The patients' monthly body weight records were used to guide the prescription of feed regimens, keeping patients approximately in energy balance. Patients were receiving one or two out of three different feeds (Ross Products Division, Abbott Laboratories Limited) which provided the following per 24 h (based on labelling information): 1272 (SD 225) kcal (5.3 (SD 0.9) MJ); 9.2 (SD 1.6; range 7.3-12.8) μg vitamin D (reference nutrient intake for individuals confined indoors 10 μg, Department of Health, 1991); 169 (SD 33) mg vitamin C (population reference intakes (PRI) /d 45 mg; European Community, 1992); and 2.1 (SD 0.4) mg thiamin (PRI 0.9-1.1 mg). Patients did not receive supplementary vitamins. A venous blood sample was taken 6-8 h after the end of overnight feeding. Plasma 25(OH) cholecalciferol was measured using a radioimmunoassay (Abbotts *et al.* 1995), vitamin C using a fluorometric assay (Vuilleumier & Keck, 1989), and thiamin using the erythrocyte transketolase (ETK) stimulation test (activation coefficient α-ETK) (Vuilleumier *et al.* 1990).

Mean circulating concentrations were 69.7 (SD 19.9) nmol/l for vitamin D, and 68.2 (SD 13.6) μmol/l for vitamin C. Mean activation coefficient for thiamin was 1.07 (SD 0.06). No patient had measurements to suggest deficiency (25(OH)cholecalciferol<20 nmol/l, vitamin C<11 μmol/l (Department of Health, 1991), α-ETK>1.2; Mahan & Escott-Stump, 1996). One patient had a plasma concentration of vitamin D that was 12 % higher than the upper reference limit (115 nmol/l), and four patients had values of vitamin C that were 5-25 % higher than the upper limit (85 μmol/l). Circulating concentrations and intakes were not significantly correlated.

The present study shows that none of the patients in this group had deficiencies of vitamins D, C or thiamin.

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Production of tumour necrosis factor-α by blood mononuclear cells increases with age and with BMI in healthy women. By P. YAQOOB[1*], E.A. NEWSHOLME[1] and P.C. CALDER[2], [1]*Department of Biochemistry, University of Oxford, South Parks Road, Oxford OX1 3QU and* [2]*Institute of Human Nutrition, University of Southampton, Bassett Crescent East, Southampton SO16 7PX*

Tumour necrosis factor-α (TNF-α) is a cytokine produced by a number of cells, but the major sources are monocytes and macrophages. Local and transient production of TNF-α is of benefit to the host in controlling immunity, inflammation and repair but sustained and systemic production can be harmful. Inappropriate production of TNF-α is observed in endotoxic shock, malaria, some cancers, and chronic inflammatory diseases such as rheumatoid arthritis. TNF-α is also produced by adipocytes. TNF-α knockout mice have significantly improved insulin sensitivity compared with their control litter mates when fed on a high-fat diet (Uysal *et al.* 1997), and genetically obese mice lacking functional TNF-α receptors have the metabolic characteristics of lean wild-type mice (Uysal *et al.* 1997). Thus, TNF-α appears to have a key role in controlling insulin sensitivity and in the development of obesity. Since obesity increases with age and is more prevalent in women than men, we investigated the capacity of mononuclear cells (MNC; a mixture of lymphocytes and monocytes) to produce TNF-α and its relationship with age and BMI in healthy women.

Blood was collected into heparin from thirteen healthy Caucasian women aged 21 - 58 (mean 42.4, SD 13.4 years) who were not diagnosed as having hyperlipidaemia, hypertension, diabetes or any chronic inflammatory disease, who were non-smokers and who were not taking any medication or the oral contraceptive pill. MNC were prepared by standard techniques (see Yaqoob *et al.* 1998) and 2 x 10^6 cells (in a final culture volume of 2 ml) were cultured in Roswell Park Memorial Institute (RPMI) medium supplemented with 2-mM glutamine, 25 ml autologous plasma/l, antibiotics and 10 μg bacterial lipopolysaccharide (LPS)/ml. In addition, whole blood was diluted 10-fold in RPMI medium supplemented with 2 mM-glutamine and was cultured (final volume 2 ml) in the presence of 15 μg LPS/ml. After 24 h the culture supernatant fractions were collected and the concentration of TNF-α was measured using ELISA kits (R&D Systems Ltd, Abingdon, UK). Pearson's linear correlation coefficients (*r*) and their significance (*P*) were calculated using the Statistical Package for the Social Sciences.

The BMI of the subjects varied from 15.1 to 35.2 kg/m^2 (mean 23.9, SD 5.1 kg/m^2). There was no significant correlation between age and BMI (*r* 0.307; $P = 0.308$). The production of TNF-α by whole-blood cultures varied over a 3.5-fold range while TNF-α production by purified MNC varied over a 5-fold range. TNF-α production correlated significantly with age and with BMI: this correlation was stronger for whole-blood cultures (*r* 0.67 v. BMI ($P = 0.017$); *r* 0.696 v. age ($P = 0.012$)) than for cultures of purified MNC (*r* 0.563 v. BMI ($P = 0.045$); *r* 0.624 v. age ($P = 0.023$)).

These observations suggest that in healthy women the capacity of MNC to produce TNF-α increases with age and with BMI. Since TNF-α is a pro-inflammatory cytokine involved in chronic inflammatory disease, increased TNF-α production with age might be related to the development of such diseases with ageing. Furthermore, the observed relationship between TNF-α production and BMI might partly explain the increased risk of rheumatoid arthritis with increased BMI (Voight *et al.* 1994). If the capacity of adipocytes to produce TNF-α is the same as that observed for MNC, this might relate to decreased insulin sensitivity and an age-related development of obesity and type 2 diabetes.

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LACK OF EFFECTIVENESS OF SHORT-TERM INTRAVENOUS NUTRITION (IVN) IN RESTORING PLASMA ANTIOXIDANT STATUS POST SURGERY. By MALCOLM BAINES[1], MARK HARTLEY[2] and ALAN SHENKIN[1], Departments of [1]Clinical Chemistry and [2]Surgery,Royal Liverpool University Hospital,Liverpool L7 8XP.

Major surgery may promote a pro-oxidative state, due to ischaemia/reperfusion processes (Halliwell, 1994) and the release of tissue contents and pro-oxidants, such as free Fe, into the circulation (Halliwell, 1989). Additionally, parenteral feeding with lipid emulsions rich in polyunsaturated fatty acids can increase peroxidative stress (Pironi *et al.*1998). The present study sought to assess the adequacy of IVN, including daily provision of standard intravenous micronutrients Additrace, Solivito N and Vitlipid N (Pharmacia) in maintaining or restoring antioxidant status in the post-operative period.

Twenty-five patients (seven females,eighteen males, age range 24-89 years) who were beginning total IVN following major thoracic, abdominal or transplant surgery, were studied. Plasma samples were taken on starting IVN and daily for the duration of feeding, which ranged from 4 to 19 d, mean 8.4 d. Plasma total antioxidant status (TAS) was assessed by the radical suppression method (Miller *et al.*1993), (Randox Labs., UK) for which our refererence ranges are 1117-1785 umol/l (females) and 1305-1855 umol (males).

On starting IVN the median TAS level was 1086 umol/l, range 608-1748 umol/l, with eighteen of the twenty-five patients (72 %) below the reference range. At the end of IVN the median TAS was 1165 umol/l, range 666-1440 umol/l, with fifteen of the twenty-five patients (60 %) still below the reference range. Of the eighteen patients who were initially deficient, fourteen (78 %) remained so after IVN. Three patients received IVN for more than 2 weeks; they showed changes in TAS of 1031 - 1134 (16 d), 1381 - 1194 (17 d) and 1196 - 1013 (19 d).Those patients who were deficient at the end of feeding had a tendency to longer duration of feeding (9.1 *v* 7.7 d), lower urate (176 *v* 245 umol/l) and lower C-reactive protein (45 *v* 70 mg/l), though these did not achieve stastistical significance.

This study has shown that a substantial proportion (72 %) of patients begining IVN have a reduced antioxidant status, which in many is not improved by IVN of up to 19 d. Further studies are required to determine if antioxidant status, or provision of additional antioxidants, influences recovery after surgery.

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"Chylomicron" composition following oral and intravenous administration of a lipid emulsion. By KEVIN EVANS, MO L. CLARK and KEITH N. FRAYN, *Oxford Lipid Metabolism Group, Radcliffe Infirmary, Oxford OX2 6HE*

Fat emulsions are widely used as a source of energy in parenteral nutrition as well as being used experimentally in models of fat metabolism. Intralipid (Pharmacia, Milton Keynes, UK) is a soyabean-oil-based emulsion composed of a triacylglycerol (TAG) core surrounded by a phospholipid (PL) layer. The size distribution of fat emulsion particles is within that of chylomicrons (75 - 1200 nm). It is believed that Intralipid particles resemble chylomicrons in their metabolism, and acquire apolipoproteins necessary for clearance rapidly once in the circulation. There is evidence that clearance of artificial lipid emulsions is not as rapid as that of native chylomicrons (Hultin *et al*,. 1995). It has previously been shown that particle size and/or TAG: PL ratio may be important in determining clearance rates of lipid emulsions from plasma (Lutz *et al*., 1989). We have therefore compared the removal of "chylomicrons" from plasma following either oral or intravenous administration of Intralipid.

Six subjects fasted overnight and were then given 40 g TAG either orally or as an intravenous infusion over 4 h. Blood samples were obtained from an arterialized hand vein. A "chylomicron" fraction was prepared from plasma at time points 180, 240 and 360 min. These time points were chosen to represent samples at around the TAG peak, and at the end of the study, when chylomicrons would have largely been cleared from the circulation. Portions of the chylomicron fraction were extracted with chloroform-methanol, and TAG and PL were separated by TLC, and their concentrations estimated by GC after methylation.

Chylomicron-TAG concentrations at 180 min were greater with intravenous fat load due to more rapid delivery of TAG to the circulation. Chylomicron-TAG concentrations decreased between 180 and 360 min ($P<0.001$), with a greater fall with intravenous fat load ($P=0.015$ for meal effect and $P=0.004$ for time by study interaction). The TAG: PL ratio decreased between 180 and 360 min following both oral and intravenous fat loads ($P=0.001$ for time effect). The decrease was greater following intravenous fat load ($P=0.024$ for time x study interaction).

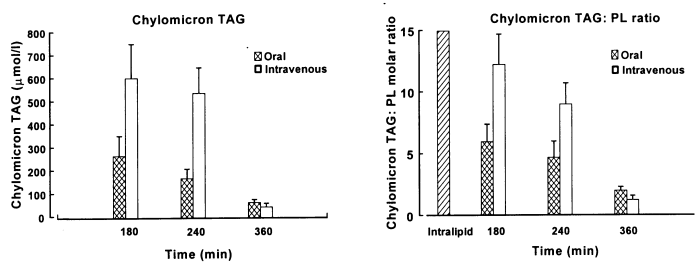

Fig. Changes in chylomicron TAG concentration and TAG: PL ratio following oral and intravenous Intralipid.

The greater decrease in chylomicron-TAG between 180 and 360 min following intravenous fat load suggests more rapid removal of chylomicrons from the circulation. This could occur by removal of intact particles or by removal of TAG by lipolysis resulting in the remnant particles having a greater density and therefore not being recovered in the "chylomicron" fraction. The decrease in TAG: PL ratio between 180 and 360 min would be expected as a result of lipolysis decreasing the TAG concentration. The difference between oral and intravenous fat loads for TAG: PL ratio suggests greater lipolysis rather than whole particle removal as particle removal would result in greater PL removal and have less effect on the TAG: PL ratio.

These results show that removal of TAG from Intralipid by lipolysis is efficient, and possibly more rapid than from native chylomicrons.

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Over 75s' annual health assessments: an opportunity to identify individuals 'at-risk' of under-nutrition? By ELAINE BANNERMAN[1], JJ. REILLY[3], WJ. MACLENNAN[4], T. KIRK[2] and F. PENDER[1], *[1]Department of Dietetics and Nutrition and [2]Centre for Food Research, Queen Margaret College, Edinburgh, [3]Department of Human Nutrition, Yorkhill Hospitals Glasgow, [4]Geriatric Medicine Unit, The University of Edinburgh, Edinburgh.*

It has been reported that the proportion of elderly individuals admitted to hospital who are undernourished is 43% (McWhirter & Pennington, 1994). This suggests that practical, reliable and valid methods to identify community-dwelling elderly individuals 'at-risk' of undernutrition, are urgently needed. Many social, physical and psychological variables have been proposed as potential 'risk-factors' for undernutrition and are increasingly included in nutritional screening tools, however their validity and reliability are largely unknown and require evaluation. Many of these proposed 'risk-factors' are frequently assessed in individuals ≥75 years old as part of the annual over 75s' assessment in primary health care (General Practice Contract, 1990) and also assessed in existing screening tools. The present study aimed to determine the relationship between nutritional status and routinely assessed social, physical and psychological 'risk-factors' of community-dwelling elderly.

A representative sample of 200 non-institutionalized individuals ≥75 years old were randomly recruited (Bannerman *et al.* 1997). Nutritional assessment included: weight (kg), knee height (cm), demispan (m), mid-upper arm circumference (cm), triceps skinfold thickness (mm). From these measurements the following indices were calculated: BMI (kg/m^2) Mindex (kg/m), Demiquet (kg/m^2) arm-muscle circumference (cm) and corrected arm-muscle area (cm^2) (Friedman *et al.* 1985). Social, physical and psychological status of subjects were assessed using standardized assessment scales: abbreviated mental test, Barthel activities of daily living, geriatric depression scale (GDS), Philadelphia Geriatric Center morale scale (PGCMS-a) and activities of living skills and resources. These scales are commonly used in the assessment of older individuals in the primary health care setting and have been shown to be reliable, sensitive and specific (Royal College of Physicians & British Geriatrics Society, 1992). Analysis was performed to determine any relationship between nutritional status and the routinely assessed 'risk factors' using parametric and non-parametric correlation coefficients, independent *t* tests and stepwise multiple regression.

There were a number of statistically significant but weak associations between nutritional status assessed by anthropometry and the proposed 'risk-factors'. There were distinct sex differences. In males the multiple regression models developed which significantly accounted for any of the variability in nutritional status, were associated with factors including morale (PGCMS-a score) and socioeconomic status ($p<0.05$). The lower the morale and the socio-economic classification of elderly men the poorer their nutritional status. These models were able to account for only 9 - 36 % of variability in nutritional status. In females, only 3 - 5 % of the variability in nutritional status could be accounted for, with GDS scores having the only significant association with nutritional status ($p<0.05$; an increased depression score associated with poor nutritional status).

In summary, relationships between nutritional status and proposed social, physical and psychological 'risk-factors' were weak. The weakness of these relationships, especially in females, means that the clinical and practical significance of these indicators as markers of nutritional risk is questionable. The commonly proposed 'risk-factors' for under-nutrition in old age, evaluated in this study should not be used alone to identify individuals at risk of poor nutritional status. The collection of anthropometric data in the over 75s should provide a better overall assessment of the nutritional status of the individual. However, there is a need for prospective studies to identify the prognostic value of various anthropometric indices (Bannerman *et al.* 1997).

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Outcome of home enteral tube feeding in adults, in the Cambridge health district, between 1986 and 1998. By ODILE DEWIT[1,2], SYLVIA M. COTTEE[2], and MARINOS ELIA[1,2], *[1]MRC Dunn Clinical Nutrition Centre, Cambridge CB2 2DH, and [2]Nutrition Team, Addenbrooke's NHS Trust, Cambridge CB2 2QQ*

Despite the increasing use of home enteral tube feeding (HETF) in the UK (BANS Working Party, 1998*a*), there is a surprising lack of information about its outcome. The committee of the British Artificial Nutrition Survey suggested that this information should be established as a matter of urgency (BANS Working Party, 1998*b*). The present study aimed to provide outcome in adults receiving HETF with common conditions: cerebrovascular accident, motor-neurone disease (MND) and multiple sclerosis (MS), and cancers of the oesophagus/oropharynx in an individual health district.

Information was established prospectively over 12 years (1986-1998) for adult patients receiving HETF (via nasogastric, gastrostomy or jejunostomy tubes) at home or in nursing homes within the Cambridge health district. For the present study, data from between 20th June 1986 and 31st March 1998 were examined (total 124 patients, fifty-one female, seventy-three male); only patients who started HETF on or after 20th June 1986 were included. Analysis of outcome was made after classifying patients into one of the following categories: continuing HETF, resumed full oral feeding, and death. The outcome information for patients who were transferred out of the area (only four in the entire study) or who had not fed for the whole duration of that period was classified as censored (c). Patients with cancer of the oesophagus/oropharynx, cerebrovascular accident, and MND + MS represented 10.5, 25.8, and 16.1 % of the 124 patients respectively. The number of patients aged 16-64, 65-74, and >=75 years respectively, were: cancer of the oesophagus/oropharynx: 6, 3, 4; cerebrovascular accident: 7, 13, 12; MND + MS: 14, 4, 2.

Observation period (months)	Cancer oesophagus/oropharynx					Cerebrovascular accident					MND + MS				
	continue (%)	death (%)	oral (%)	*n**	c†	continue (%)	death (%)	oral (%)	*n**	c†	continue (%)	death (%)	oral (%)	*n**	c†
3	67	33	0	12	1	79	14	7	29	3	81	19	0	16	4
6	25	75	0	12	1	63	29	8	24	8	69	31	0	16	4
12	0	83	17	12	1	50	36	14	22	10	56	44	0	16	4
36						14	67	19	21	11	25	75	0	12	8
48						10	71	19	21	11	0	100	0	9	11

*Number of patients with known outcome at the end of each observation period
†Number of patients with censored outcome

Mortality on HETF, at 12 months, was significantly higher in the cancer group than in the combined cerebrovascular and MND & MS groups (continuity corrected χ^2 5.4, $P<0.05$). At 36 months HETF, no patient (0 %) in the MND + MS group had returned to full oral feeding, while four (19 %) with cerebrovascular accident did so (Fisher's exact test $P=0.27$). For cerebrovascular accident, outcome did not change significantly with age: at 12 months, out of twelve patients aged less than 75 years, six had died and three had resumed full oral feeding; and out of nine patients aged 75 years or over, two had died and none had resumed full oral feeding. Outcome did not vary significantly with sex either.

The results of the present study suggest that (1) the overall mortality while still on HETF is greatest in patients with cancer of the oesophagus/oropharynx; (2) the return to full oral feeding is unlikely in patients with MND and MS, whereas in patients with cerebrovascular accident, it occurs in an increasing proportion (up to nearly a fifth of patients) during the first 3 years; (3) the mortality in the three groups is high in the first 3 months of HETF (14-33 %).

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Postprandial lipaemia after isoenergetic 3 d high-carbohydrate and high-fat diets. By CHRISTINA KOUTSARI, DALĒ MALKOVA and ADRIANNE E. HARDMAN, *Human Muscle Metabolism Research Group, Loughborough University, Loughborough LE11 3TU*

An exaggerated postprandial lipaemic response is increasingly recognized as an important risk factor for coronary artery disease (Ebenbichler *et al.* 1995). Manipulation of the carbohydrate (CHO) and fat content of the diet is reported to induce changes in the activity of lipoprotein lipase, at least in skeletal muscle (Jacobs *et al.* 1982). This might be expected to influence triacylglycerol (TAG) removal. The aim of the present study was, therefore, to test the hypothesis that short-term changes in the macronutrient content of the diet influence postprandial lipaemia.

Eight healthy, non-smoking, recreationally active men aged 26.7 (SD 3.8) years and with a BMI of 25.1 (SD 1.8) kg/m^2 participated. Their normal daily energy intake, determined with the weighed food intake technique, was 12.2 (SD 1.5) MJ with 51 (SD 10), 34 (SD 10) and 15 (SD 3) % energy coming from CHO, fat and protein respectively. Each subject performed two oral fat-tolerance tests, with an interval of 2 weeks. The first began the morning after a 3 d high-CHO diet which comprised 68 (SD 3) % energy from CHO, 17 (SD 4) % from fat and 15 (SD 1) % from protein. The second began the morning after a 3 d high-fat diet comprising 18 (SD 4) % energy from CHO, 67 (SD 5) % from fat and 16 (SD 3) % from protein. The diets were isoenergetic (high-CHO diet 12.4 (SD 2.1) MJ; high-fat diet 12.3 (SD 1.8) MJ) and approximated each subject's normal energy intake. Subjects refrained from exercise for 6 d before each fat-tolerance test. For the 3 d preceding first diet intervention, subjects weighed and recorded their food intake and then repeated this intake during the days preceding subsequent interventions. For each fat-tolerance test, subjects arrived at the laboratory after a 12 h fast and blood samples were obtained by venous cannulation in the fasted state and at intervals for 6 h after consumption of the test meal. This comprised cereal, coconut, nuts, chocolate, fruit and whipping cream (per kg of body mass: 1.2 g fat, 1.2 g CHO, 67 % energy from fat, 29 % from CHO). Plasma was collected for measurement of total cholesterol and HDL-cholesterol (fasted state only), and for TAG, glucose and non-esterified fatty acids. Serum was collected for determination of insulin. The total lipaemic and insulinaemic responses were determined as the areas under the TAG concentration *v.* time curve and the insulin concentration *v.* time curve respectively. The incremental lipaemic response was the total lipaemic response minus the fasting values extrapolated over the 6 h postprandial period. Responses were compared between trials using paired *t* tests. The main results are shown in the Table.

	Fasted TAG (mmol/l)		Total lipaemic response (mmol/l·6 h)		Incremental lipaemic response (mmol/l·6 h)		Fasted insulin (μIU/ml)		Insulinaemic response (μIU/ml·6 h)	
Trial	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
High-CHO	1.18	0.18	13.18	1.63	5.84	0.21	10.8	0.9	111.9	26.3
High-fat	0.62***	0.09	6.74**	0.50	3.27**	0.47	8.8*	0.6	107.8	17.2

Mean values were significantly different from high-CHO trial, *P<0.05, **P<0.01, *** P<0.001.

After the high-fat diet the total lipaemic response was 44 (SE 7) % lower and the incremental response was 40 (SE 7) % lower, compared with after the high-CHO diet. The findings show that short-term changes in the macronutrient content of the diet profoundly affect the fasted TAG and the TAG response to an oral fat challenge. Mechanisms other than changes in insulin action seem to be responsible for these alterations.

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Distress from hunger in patients receiving parenteral nutrition at home and in hospital. By REBECCA J. STRATTON and MARINOS ELIA, *MRC Dunn Clinical Nutrition Centre, Hills Road, Cambridge CB2 2DH*

Appetite sensations, including those that are distressing, may influence the outcome of parenteral nutrition (PN) in situations when oral feeding is either clinically indicated or contraindicated. However, there is a remarkable lack of information about appetite sensations during PN. The aim of the present study was to assess and to compare the frequency of appetite sensations occurring in patients with acute disease receiving PN in hospital, with those occurring in patients with chronic disease receiving PN at home.

The hospital group consisted of twenty-eight hospital patients consecutively started on PN by the nutrition team. The main indications for feeding were Crohn's disease, severe pancreatitis and complications following gastrointestinal surgery. The mean age of patients was 54 (SD 18) years, weight 64.6 (SD 17.0) kg and BMI 22.6 (SD 4.6) kg/m^2. The average duration of PN was 12 (SD 10) d. Daily PN provision was 8.37 (SD 1.03) MJ, (equivalent to 1.42 (SD 0.28) x BMR; Schofield *et al.* 1985), in order to meet estimated requirements of energy. The patients receiving home PN (home group) consisted of sixteen patients in whom food intake was universally contraindicated. The mean age of patients was 42 (SD 14) years, weight 57.9 (SD 10.3) kg and BMI 20.8 (SD 2.59) kg/m^2. The average duration of PN was 10 (SD 16) months. Daily PN provision was 8.72 (SD 1.2) MJ, (equivalent to 1.49 (SD 0.2) x estimated BMR). The main indications for PN were short bowel syndrome and Crohn's disease. All patients were clinically stable.

Hunger, distress from hunger and other appetite sensations were assessed using 10 simple questions. In hospitalized patients assessment was conducted every 2-4 d, at the same time each morning, when the appetite sensations experienced during the preceding day were recorded. For patients receiving PN at home, appetite sensations were assessed on two or three occasions at 3-monthly intervals.

Appetite sensations during day	% Home PN patients (n 16)	% Hospital PN patients (n 28)
Hunger	75	34*
Distress from hunger	44	12*
Desire to eat	88	40*

Values were significantly different from those for home PN patients, *P < 0.05 (Chi squared test)

Appetite sensations (see Table), including distress from hunger (expressed as a percentage of the number of assessments) occurred less frequently in the hospitalized patients than those at home (P < 0.05 Chi squared). Food items were missed with similar frequency in both hospitalized (54 %) and home (69 %) patients. Appetite sensations (hunger, distress from hunger, desire to eat) did not occur more frequently in those with a BMI < 20 kg/m^2 than in those > 20 kg/m^2. They also did not relate to the prescribed energy intake from PN, irrespective of whether this intake was expressed as an absolute amount or as a multiple of BMR.

This study suggests that appetite sensations, including distress from hunger, are common in patients receiving PN (particularly in those receiving PN at home), despite a prescribed energy intake to meet estimated requirements.

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Resting energy expenditure should be measured in patients with cirrhosis, not predicted. By ANGELA M. MADDEN and MARSHA Y. MORGAN, *Department of Medicine, Royal Free Hospital, London NW3 2QG*

Prediction equations can be used to estimate resting energy expenditure (REE) when facilities for direct measurement are not available. However, the validity of these predicted estimates has not been studied systematically in patients with cirrhosis. The aim of the present study was to compare values of REE predicted using the Harris-Benedict (HBREE)(Harris & Benedict, 1919) and Schofield (SCHREE)(Schofield, 1985) formulas with measured values (MREE) in a large group of patients with cirrhosis and a group of comparable healthy volunteers.

REE was measured, using indirect calorimetry (2900 Metabolic Cart, SensorMedics, Bilthoven, The Netherlands), in 100 cirrhotic patients (fifty-six men, forty-four women; mean age, 49.3 (range 26-71) years; mean weight, 72.6 (range 38.3-111.8) kg) and forty-one healthy volunteers (twenty men, twenty-one women; mean age 48.9 (range 22-79) years; mean weight, 73.1 (range 51.5-100.5) kg) after an overnight fast. The seventy-two patients with alcohol-related cirrhosis had abstained from alcohol for a minimum of 5 d. All subjects had consumed adequate amounts of food in the days preceding assessments. Data were collected for a minimum of 30 min. HBREE and SCHREE were calculated using actual rather than dry body weight.

Population		MREE		HBREE				SCHREE			
		MJ/24 h		MJ/24 h		% of MREE		MJ/24 h		% of MREE	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Patients:	♂ (*n* 56)	7.60	1.30	7.07**	0.87	94	12	7.32	0.78	98	14
	♀ (*n* 44)	6.10	1.07	5.56***	0.54	93	13	5.64*	0.46	95	14
Volunteers:	♂ (*n* 20)	7.38	1.12	7.03	0.86	96	10	7.26	0.74	100	12
	♀ (*n* 21)	5.94	1.02	5.78	0.61	99	14	5.76	0.56	99	13

Mean values were significantly different from MREE: *$P<0.001$, **$P<0.0005$, ***$P<0.0001$.

No significant differences were observed between mean values for MREE, HBREE and SCHREE in the healthy volunteers although individual predicted values varied widely from measured values (-1.73 to +1.51 MJ). In the patient population, mean values for HBREE and SCHREE underestimated mean MREE; the differences were significant with both formulas in the women but only significant with the Harris-Benedict formulas in the men; overall individual predicted values varied widely from measured values (-3.69 to +1.75 MJ).

In groups of healthy volunteers, both prediction formulas provide useful estimates of REE, although predicted data in individuals should be interpreted cautiously. However, in patients with cirrhosis, neither formula provides a useful estimate of REE on either a group or individual basis. Thus, REE should be measured in this patient population, not predicted.

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The influence of sex on changes in body composition in advanced non-small-cell lung cancer (NSCLC) patients undergoing chemotherapy. By MICHELLE N. HARVIE[1], I.T. CAMPBELL[1], N. THATCHER[3], A. HOWELL[3] and A.D. BAILDAM[2], *[1]University Department of Anaesthesia and [2]University Department of Surgery, Withington Hospital, Manchester M20 2LR and [3]University Department of Medical Oncology, Christie Hospital, Manchester M20 4BX*

Women have a better prognosis than men for NSCLC. The aetiology of this difference is not known but faster rates of initial weight loss and greater overall weight loss during the disease course have been reported in men; this may influence survival (Palomares *et al.* 1996).

Changes in body weight and composition were measured in fifteen males and six females with newly diagnosed NSCLC undergoing chemotherapy for 3-7 (median 4.5) months. Groups were comparable for age; male 48-66 (median 58) years, female 46-71 (median 60) years. Initial BMI; male 18.2-31.4 (median 25.1), female 18.7-34.3 (median 22.1). Weight change over the previous 6 months; male -18.0 to +7% (median -3%); female -14 to 0% (median -11%). Smoking; male 6 smokers/9 non smokers, female 3 smokers/3 non smokers. Stage of disease; male 12 localised/3metastatic, female 2 localised/4 metastatic. Patients were seen prechemotherapy (Time 1) and 1 month after completion of chemotherapy (Time 2). On each occasion weight, height and skinfolds at triceps, biceps, subscapular, suprailiac (SI), abdomen (ASF) and thigh sites were measured; fat-free mass (FFM) and body fat (%) were calculated from skinfolds (Durnin & Womersley, 1974).

	Male (*n* = 15)					Female (*n* = 6)				
	Time 1		Time 2			Time 1		Time 2		
	Mean	SD	Mean	SD	*p**	Mean	SD	Mean	SD	*p**
Weight (kg)	77.7	15.5*	78.2	15.1	0.79	63.5	20	62.8	18	0.56
FFM (kg)	57.6	9.2	55.6	8.6	0.063	40.8	8.0	41.4	8.2	0.57
Body fat %	25.0	5.5	27.9	7.9	<0.05	33.7	6.7	32.5	6.5	0.16
ASF (mm)	28.0	12.8	34.0	18	0.055	33.0	15	32.0	17	0.7
SI (mm)	13.6	8.5	19.0	13	P<0.05	21.0	13	19.0	13	0.37

*Statistical significance of difference between Times 1 and 2.

Minimal weight change was observed in both men and women undergoing chemotherapy but the men gained fat and there was a tendency for FFM to decrease. Increases in SI and ASF imply that the increase in fat in men is predominantly central. Conversely, women appear to conserve FFM. This study suggests that there are different patterns of change in body composition between the sexes as they undergo chemotherapy for NSCLC.

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Comparison of fundamental bio-electrical impedance analysis and anthropometric methods for predicting magnetic resonance imaging estimates of lower limb muscle cross-sectional area. By N.J. FULLER[1], C.R. HARDINGHAM[2], M. GRAVES[2], N. SCREATON[2], A.K. DIXON[2], L.C. WARD[3] and M. ELIA[1], *[1]MRC Dunn Clinical Nutrition Centre, Cambridge CB2 2DH, [2]Department of Radiology, Addenbrooke's Hospital, Cambridge CB2 2QQ and [3]Department of Biochemistry, University of Queensland, Brisbane Qld 4072, Australia*

The aim of the present study was to use magnetic resonance imaging (MRI) reference estimates of muscle cross-sectional areas (A_m) to evaluate a simple fundamental bio-electrical impedance analysis (BIA) method against anthropometry in well-defined sections of thigh and lower leg (calf). Sixteen healthy volunteers (eight male, eight female), aged 41-62 years and mean BMI 26.8 (SD 5.4) kg/m^2, underwent MRI scans of the legs, from which the mid-point slices of 20 cm thigh and 10 cm calf sections were analysed for tissue composition. Circumference (C) and skinfold thickness (SFT) at this point and section impedance (R, at 50 kHz), over the section length (L), were measured. Cross-sectional area (A) was calculated assuming circularity ($C^2/4\pi$) and muscle area (A_m) was estimated from anthropometric measures assuming a constant 6 cm^2 (mean MRI value) for bone including marrow:

$$A_m = A - \left(\frac{CxSFT}{2}\right) - 6,$$

and by the simple fundamental BIA equation that incorporated specific resistivities of muscle and adipose tissue:

$$A_m = 1.643 \times \left(\frac{L}{R} - \frac{A}{16.0}\right).$$

Bias and 95 % limits of agreement were established between methods (MRI minus fundamental BIA). Reproducibility was established using four observers on a sub-group of four volunteers.

	Group value by MRI		Anthropometry		Fundamental BIA	
	Mean	SD	Bias	95% Limits of agreement	Bias	95% Limits of agreement
Thigh muscle A (cm^2)	123.5	30.6	-36.6	-91.9, 18.8	-5.4	-62.7, 51.9
Calf muscle A (cm^2)	62.7	15.1	-12.9	-35.9, 10.0	5.7	-8.8, 20.2

Intra- and interobserver variabilities respectively, were: thigh muscle anthropometry, 1.7 and 3.5 % and fundamental BIA, 1.8 and 3.8 %; for calf muscle anthropometry, 3.2 and 8.2 % and fundamental BIA, 2.3 and 4.5 %.

This study suggests that the fundamental BIA method has the advantage over lower limb anthropometry in providing better predictions of MRI estimates of muscle area, with similar or better reproducibility. However, because of the wide 95 % limits of agreement (-50 to 42 % for thigh; -14 to 32 % for calf) associated with the fundamental BIA method, it is likely to be of greater value for assessing lower limb muscle area in groups of subjects rather than individuals.

The use of multiple frequency bioimpedance to assess fluid balance in critical illness. By I.T. CAMPBELL[1,2], ANILA KHAN[1,2], M. BOLTON[3], P. NIGHTINGALE[1], M.O. COLUMB[1] and S.J. BROOKES[4]. *[1]Intensive Care Unit, [2]University Department of Anaesthesia and [3]Department of Clinical Engineering, Withington Hospital, Manchester M20 2LR and [4]Europa Scientific, Crewe CW1 6ZA*

Critically ill patients retain fluid, up to 30 litres and more. In individuals ill for prolonged periods it is virtually impossible to assess fluid balance accurately, but as a non-invasive method of doing so bioimpedance has its obvious attractions. We have previously described the the use of single frequency (50 kHz) impedance to assess body water in these individuals but the interindividual errors were too large to be acceptable (Foley *et al.* 1998). The correlation (r) between conductance (height^2/impedance) at multiple frequencies (5-500 kHz; Multiscan 5000, Bodystat Ltd, Douglas, Isle of Man) and body water (measured using deuterium analysed by Continuous Flow Isotope Ratio Mass Spectrometry following equilibration with H_2) was investigated in ten critically ill patients; in three patients multiple measurements were made, in two on four occasions and in one on six.

Frequency		All patients	Patient 1	Patient 2	Patient 3
		(*n* = 10)	(*n* = 4)	(*n* = 6)	(*n* = 4)
5 kHz	*r*	0.869	0.574	0.862	0.622
	SEE	6.42*	4.33	5.40	9.96
50-500 kHz	*r*	0.790-0.831+	0.561-0.574	0.689-0.808	0.308-0.381
	SEE	7.23-7.96+	4.34-4.40	6.27-7.72	9.96-12.1

* litres + range *r* Pearson correlation coefficient

Bioimpedance at 5 kHz gave a better correlation with the deuterium measurement than any of the other frequencies, both between and within patients. Between patients, and within one of the patients (no.1), the correlation between conductance and frequency at frequencies between 50 and 500 kHz was not significant. Within patients 2 and 3 the correlation coefficients between conductance and frequency were -0.864 and -0.925 ($P<0.001$) respectively. Contrary to expectation, they were both negative i.e. the higher the frequency the worse was the correlation between conductance and frequency.

The fact that 5 kHz gave the best correlation is probably a result of the expanded extracellular fluid volume normally seen in these patients. If bioimpedance is to have a role in assessing fluid balance in this group attention is probably best focused on the lower frequencies.

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Plasma vitamin E and urate levels in cystic fibrosis liver disease. By SIMON C. LING[1], PETER GALLOWAY[2], ANNE S. HOLLMAN[2], LAWRENCE T. WEAVER[1], and JAMES Y. PATON[1], [1]*Department of Child Health, University of Glasgow and* [2]*Royal Hospital for Sick Children, Yorkhill, Glasgow G3 8SJ*

Cholestatic liver disease (LD) is common in cystic fibrosis (CF) but is subclinical in the majority of affected children (Ling *et al.* 1997), with progression to severe disease and portal hypertension in only 4 %. The variable expression of LD in children with CF, ranging from a normal liver to life-threatening disease, is poorly understood, and is not related to genotype. In CF, defective Cl^- channel permeability causes secretion of concentrated bile, and loss of taurine from the gastrointestinal tract creates a relative excess of hydrophobic, glycine-conjugated bile acids. Mucus production is also deficient, and the biliary epithelium is therefore exposed to damage from a more toxic bile. In animal studies, elevated concentrations of hydrophobic bile acids cause oxidative liver damage that can be prevented by antioxidants such as vitamin E (Sokol *et al.* 1998). CF is associated with fat-soluble-vitamin deficiency, which is not always corrected by vitamin supplementation therapy. We hypothesized that reduced vitamin E absorption contributes to the development or progression of CF LD.

Longitudinal data from forty-six children with CF were analysed retrospectively. Each child was assessed annually for evidence of LD, for a median of 3 (range 2-5) years. LD was defined as a scalloped liver edge or patchy liver parenchyma on ultrasound scan. We measured total plasma vitamin E (Fabianek *et al.* 1968), urate (Vitros, Ortho Diagnostics) (a circulating antioxidant whose plasma level is largely unaffected by diet), cholesterol, and C-reactive protein (CRP) at each assessment, and data from an assessment were excluded if the CRP was greater than 7 mg/l.

Plasma vitamin E, vitamin E:cholesterol ratio, and urate levels did not differ between children with no LD or established LD, or in children before and after development of LD. The difference in vitamin E status before and after the development of CF LD in ten children did not reach statistical significance (paired t test). The mean dose of supplementary vitamin E received by forty children did not differ between those with and without LD.

	No LD (*n* 14)		Established LD (*n* 22)		Developing LD (*n* 10)			
					Before LD		After LD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Vitamin E (μmol/l)	19.2	6.0	18.9	6.7	19.8	6.9	18.0	5.6
Vitamin E:cholesterol	5.42	1.29	5.61	1.25	6.19	2.68	5.39	1.74
Urate (mmol/l)	0.27	0.05	0.27	0.07	0.28	0.09	0.29	0.08

The development or progression of CF LD was not associated with low circulating levels of vitamin E or urate in this group of children with CF. Further studies are needed to elucidate the complex relationship between LD, oxidative stress, inflammation and malnutrition in CF, and should investigate the potential role of other antioxidants.

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Dietary eicosapentaenoic acid modulates the immune system in Balb/c mice. By MATTHEW D. BARBER, KENNETH C.H. FEARON and JAMES A. ROSS, *University Department of Surgery, Royal Infirmary of Edinburgh, Edinburgh EH3 9YW*

It has been suggested that the *n*-3 polyunsaturated fatty acid eicosapentaenoic acid (EPA) has immunosuppressive effects and that these may be detrimental in some circumstances (Meydani *et al.* 1991). In the present study we examined the effect of an EPA-enriched diet upon aspects of the immune response in a mouse model.

Female, 6-week-old Balb/c mice were fed on a fat-free diet to which was added oil to make up 50 g/kg of the final diet weight using either maize oil or 95% pure EPA as a diester with propan-1,3-diol (40 g/kg, plus 10g maize oil/kg). Feed was prepared weekly and changed daily. 5 g/mouse per d was supplied. Oils were stored under N_2 with no additional antioxidants. After 10 and 24 d on the experimental diet mice were killed and their spleens removed. Splenocytes were extracted and examined by flow cytometry. Splenocytes were cultured in the presence of fetal calf serum to examine cytokine production by ELISA and proliferation by thymidine incorporation after stimulation by anti-CD3 (with interleukin-2) or concanavalin A. Mouse tissues were examined for incorporation of EPA by fatty acid analysis.

There was no difference in food consumption or weight change between mice fed on the control and EPA-enriched diets. There was no change in the composition of populations of splenocytes between mice fed on the two study diets. There was at least a 25 % reduction in the splenocyte proliferation index in animals fed on the EPA-enriched diet after 10 and 24 d when stimulated by concanavalin A (P <0.01), but no difference in proliferation index when cells were stimulated with anti-CD3 and interleukin-2 (P >0.5). There was at least a 50 % increase in the production of tumour necrosis factor by splenocytes from mice fed on the EPA-enriched diet after 10 and 24 d when stimulated by lipopolysaccharide (P <0.0005). However, there was no difference in *ex vivo* lipopolysaccharide-stimulated production of interleukin-6 between mice consuming the two diets at either time point (P >0.05).

Fatty acid analysis revealed at least a 10-fold increase in the proportion of EPA in the phospholipids of tissues of mice fed on the EPA-enriched diet. There were also large increases in the quantities of the metabolites of EPA, docosapentaenoic acid and docosahexaenoic acid. These changes were accompanied by substantial falls in the proportions of the *n*-6 fatty acids linoleic and arachidonic acid within tissue phospholipids.

The present study found that rather than producing a generalized immunosuppression the administration of about 10 g EPA/kg has more subtle effects in modulating the immune system. While the proliferation index was reduced in response to a non-specific stimulus (concanavalin-A), there was no difference in response to a stimulus mimicking normal antigen-specific T cell activation (anti-CD3/interleukin-2). Similarly, there were inconsistent changes in the non-specific humoral response as measured by proinflammatory cytokine production. The observed effects of EPA may explain some of its reported beneficial effects in inflammatory conditions without producing detrimental effects upon antigen-specific immunosurveillance.

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The percentage of mononuclear cells expressing intercellular adhesion molecule-1 increases with age. By P. YAQOOB[1*], E.A. NEWSHOLME[1] and P.C. CALDER[2], *[1]Department of Biochemistry, University of Oxford, South Parks Road, Oxford OX1 3QU and [2]Institute of Human Nutrition, University of Southampton, Bassett Crescent East, Southampton SO16 7PX*

Cell-surface adhesion molecules are involved in cell-cell interactions, inflammation, and leukocyte trafficking between body compartments. As well as physiological roles, it is now accepted that some adhesion molecules are involved in various pathologies. Intercellular adhesion molecule-1 (ICAM-1) is expressed on the mononuclear cells (MNC; a mixture of lymphocytes and monocytes) that infiltrate inflamed synovium in rheumatoid arthritis (Cronstein, 1994), and is thought to play a pivotal role in the recruitment of MNC to, and therefore the growth of, the atherosclerotic plaque (Poston *et al.* 1992). Recently, it was demonstrated that high plasma levels of soluble ICAM-1, which is shed from the surface of MNC and other cells such as endothelial cells, are associated with increased risk of myocardial infarction and that this risk is independent of other risk factors (Ridker *et al*. 1998). In addition, the percentage of endothelial cells in endocardial biopsies which expressed ICAM-1 was highly predictive of cardiovascular disease (Labarrere *et al*. 1997). Thus, it appears that inappropriate expression of ICAM-1 plays a key role in the development of chronic inflammatory disease and atherosclerosis. To our knowledge, there have been no reports of an association of ICAM-1 expression with age. Therefore, in the current study this association was investigated.

Blood was collected from thirty four healthy Caucasian men aged 21 - 71 (mean 41.9, SD 14.2 years) who were not diagnosed as having hyperlipidaemia, hypertension, diabetes or any chronic inflammatory disease, who were non-smokers (two subjects smoked < 10 cigarettes per d) and who were not taking any medication. MNC were prepared by standard techniques and were incubated with a murine monoclonal antibody against ICAM-1 and then with a fluorescently-labelled rat antibody against murine immunoglobulin (see Yaqoob *et al.* 1998). The percentage of MNC which were fluorescently labelled was determined using a Becton Dickinson FACScan flow cytometer. Pearson's linear correlation coefficient (r) and its significance (P) were calculated using the Statistical Package for the Social Sciences.

The proportion of MNC expressing ICAM-1 varied from 7.6 to 33.6 % among the subjects (mean 20.2 (SD 6.9) %). There was a significant linear correlation between age and the percentage of MNC expressing ICAM-1 (r 0.649; $P < 0.001$).

To our knowledge, this is the first report of an association between adhesion molecule expression in man and ageing. This age-related increase in expression of ICAM-1 is particularly interesting since ICAM-1 expression on MNC and other cell types is positively associated with cardiovascular and chronic inflammatory diseases. The reason for increased ICAM-1 expression with ageing is unclear, but ICAM-1 gene expression is upregulated by oxidative stress (Roebuck *et al*. 1995) and so these results perhaps represent cumulative exposure to such stress. One implication of these observations is that age-matched controls must be used when studying expression of cell-surface molecules in pathological states or with dietary or pharmacological interventions.

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The stability of vitamin E in parenteral nutrition (PN) mixtures during administration. **By MICHAEL C. ALLWOOD and HELEN MARTIN,** ***Pharmacy Academic Practice Unit, University of Derby, Mickleover, Derby DE3 5GX***

Vitamin E is stable during storage in PN mixtures (Billion-Rey et al. 1993). It is less clear if vitamin E is stable during administration. While Dahl et al. (1994) reported no losses during simulated administration, Drott et al. (1991), in contrast, reported substantial losses. Vitamin E is degraded by photo-oxidation, and therefore the presence of dissolved O_2 in the mixture could influence losses during administration. O_2 is normally absent from complete PN mixtures prepared in multilayered bags. We therefore set out to investigate the influence of the bag on degradation of vitamin E during exposure to daylight. PN mixtures containing Synthamin 9® 200 ml, glucose (200 g/l) 300 ml, Additrace® 2 ml and Cernevit® 1 ml were prepared in 500 ml Ethyl Vinyl Acetate (EVA) or multi-layered (Ultrastab®) bags. Simulated infusion was performed at 80 ml/h in daylight and samples collected in N_2 filled amber vials, for stability-indicating HPLC analysis (Billion-Rey et al. 1993).

	% remaining (zero time =100 %) in infusate after infusion for (h):						
Bag type	1	2	3	4	5	6	Control in dark
EVA	98	85	75	25	8	6	99
Multi-layered	99	98	95	96	97	98	100

Results in the Table (mean of two tests) show that vitamin E losses were far greater if the PN mixture was prepared in EVA, as compared with multi-layered bags. No losses were observed in control bags in the dark, suggesting that losses were not associated with absorption to the bag. In tests in which PN mixtures were prepared in glass vials, with or without N_2-overlay to remove O_2, solutions exposed to daylight were stable in N_2-overlayed solutions but degraded rapidly in air-containing vials. These results suggest that vitamin E is sensitive to daylight only in the presence of O_2. Vitamin E in PN mixtures infused from multi-layered bags , in which O_2 has been depleted by reaction with ascorbic acid, shows substantial reduction in its sensitivity to daylight during administration.

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The stability of Glutamine after addition to a 3-compartment TPN bag. By GIL HARDY[1] and ADELE JONES[2]. [1]*School of Biological & Molecular Sciences, Oxford Brookes University, Oxford, OX3 0BP,* [2]*Pharmacy, Gloucester Royal Hospital, Gloucester, GL1 3NN*

Distorted Glutamine (Gln) homeostasis after surgical stress, trauma or sepsis results in diminished Gln availability and profound Gln depletion. Supplementation of TPN by 20-25g Gln per day has been reported to improve late survival and reduce intensive care costs (Griffiths *et al.* 1997). The stability of various pharmacy-compounded Gln containing mixtures has been previously demonstrated (Hardy *et al.* 1993) and we now report on Gln stability when added to an industrially prepared 3-compartment TPN bag.

A 2.5% w/v sterile solution of L-Gln (Oxford Nutrition) (800ml) was transferred aseptically into a previously mixed bag of Clinomel N7-1000 (Baxter Healthcare) (2000ml) with added trace elements and vitamins. The resultant All-In-One (AIO) mixture provided 100g amino acids (17gN), 20g Gln (48.0 mM) 2000 kcal (60:40 glucose: fat) Na 56, K 126, Mg 4, Ca 6.75, P 64mmol in 2.85 litre. After the initial sampling (Day 0) the mixture was stored at RT for 24 hours before a second sampling (Day 1) then stored at 4-8°C for an additional 14 days and re-sampled (Day 15). Samples were frozen for subsequent testing. Duplicate samples were analysed by standard enzymatic methods for Gln, Glutamate (Glu) and NH_3.

Gln content was unchanged from Day 0 (48.0 mM) to Day 1 (48.0 mM) at RT and thereafter, decreased by less than 0.1% per day up to Day 15 (47.5mM). Glu was essentially unchanged and NH_3 increased from 0.06 mM (Day 0) to 0.10 mM (Day 15). The homogeneous mixture showed no visible evidence of emulsion breakdown.

We therefore conclude that an aqueous solution of Gln can be accommodated in a pre-mixed 3 compartment TPN bag. This Gln-containing AIO admixture exhibits minimal loss of Gln during RT then refrigerated storage of 14 days and the physical stability does not appear to be adversely effected. Since it is recommended to use the initial ternary mixture within 48 hours of mixing, the stability and use of the Gln-enriched mixture over this time frame is pharmaceutically acceptable.

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Assessing the potential for changing the pharmacist's role in prescribing neonatal parenteral nutrition. By M. POWELL[1] and H. MARTIN[2], J. PUNTIS[3], I. GOSS.[2] [1] *University of Leeds Business School, Leeds LS2 9JT and* [2]*Pharmacy, General Infirmary at Leeds, LS2 9NS and* [3]*Neonatal Unit, General Infirmary at Leeds, LS2 9NS.*

The British Pharmaceutical Nutrition Group Conference recently voted against a motion that the future role of the parenteral nutrition (PN) pharmacist should be entirely clinical (Anon, 1998), despite widespread use of pharmacist prescribing in the USA (Farrell *et at.*, 1997) and National Health Service promotion of new clinical roles for nurses and professions allied to medicine. Pharmacists are already involved, to varying degrees, in the PN-prescribing process in the UK, but very little empirical evidence is available. The present paper provides preliminary information on the extent and nature of the pharmacist's role in prescribing neonatal PN in the UK, and assesses the potential for changing the pharmacist's role through increased involvement.

Data were drawn from a national study of pharmacists responsible for PN in all hospitals with neonatal units having at least two intensive care cots. The response rate was 95 %, and of those responding, 160 pharmacists provided a PN service to their neonatal units. The mean number of neonatal prescriptions was 909 per year with a standard deviation of 876, reflecting the great variation in the size of neonatal units. Some important differences in practice were identified. The use of computer-aided processing tools was common in pharmacies serving larger units (70 %), with 42 % using Pharmacia (Kabi). Only 16 % of doctors used a computer-aided prescribing tool. Whilst 19 % reported that neonatal PN prescriptions could be signed by a nurse or pharmacist, this was normal practice in only 13 % of cases. Doctors did not determine the final feed content in 13 % of cases. The perceived benefits of increasing pharmacist involvement in ward level prescription were potential cost savings from less wastage and time savings, improved education of junior medical staff, improved communications, and reducing the number of interventions to ensure a stable feed is prescribed. The perceived costs were the need to provide additional cover and new role training for clinical pharmacists, resistance to change and the deskilling of doctors.

The analysis showed no significant relationship between size of neonatal units and computer usage, suggesting that the introduction of pharmacists with computer-aided processing/prescription software could reap substantial cost savings in time alone. There was a significant association between standard feed bag use and both computer usage (χ^2=6.3, d.f. 2, P=0.042) and neonatal unit size (χ^2=5.7, d.f. 1, P=0.016). Standard feedbags were more frequently used in larger units without computer software, suggesting that the introduction of pharmacy software for tailored feeds could be cost effective in many cases. Larger units are also more likely to use a pharmacist as the prescription signatory. The analysis also indicated that the perceived benefits outweigh the perceived costs.

In conclusion, the study provides evidence that pharmacists and neonatal nurses are already directly involved in preparing, writing and signing PN prescriptions in up to 13 % of units and that there could be potential cost savings and other benefits from introducing this practice into medium- and large-scale units, particularly with the introduction of computer software. A detailed study of practice change is required to establish the potential for cost savings and its impact on clinical outcomes.

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Outcomes of percutaneous endoscopic gastrostomy tube insertion 1991-7. By BERNICE L. LITCHFIELD AND JEREMY M. D. NIGHTINGALE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

Percutaneous endoscopic gastrostomies (PEG) are commonly inserted into patients who have a functioning gut, but cannot maintain their nutritional status with their oral intake. This retrospective study reviews the indications, outcomes and reported complications of PEG inserted at Leicester Royal Infirmary between January 1991 and December 1997. Patients were identified from computerized endoscopy records. Hospital notes were examined. One year patient survival data include only patients in whom the PEG was inserted before July 1997.

In all 234 Freka 9 gauge PEG had been inserted. The reasons for the PEG were cerebrovascular accident (CVA) *n* 84, motor neurone disease (MND) *n* 32, ear nose and throat surgery (ENT) *n* 28, general/vascular surgery (G/V Surg) *n* 25, head injury or road traffic accident (Trauma) *n* 16, multiple sclerosis (MS) *n* 9, human immunodeficiency virus (HIV) infection *n* 8, Crohn's disease *n* 4 and other *n* 28.

Figure. PEG insertion 1991-7 (*n* 234)

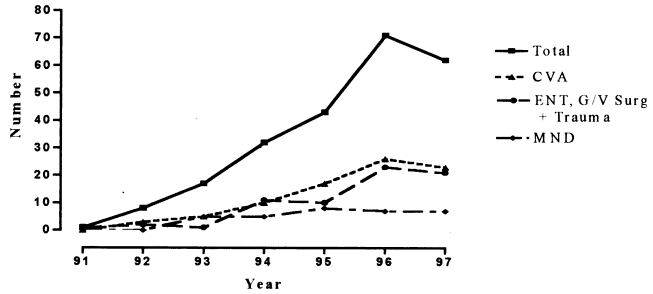

Table. Patient survival at different times after PEG insertion

Time after insertion (months)	0	3		6		12	
Patient diagnosis	*n*	*n*	%	*n*	%	*n*	%
CVA	69	32	46	17	25	11	16
MND	26	16	62	11	42	4	15
G/V Surg	25	21	84	10	40	6	24
ENT	19	15	79	10	53	8	42
Trauma	15	15	100	15	100	15	100
MS	8	6	75	5	63	5	63
HIV	7	3	43	1	14	1	14

No problems of leakage were reported around the PEG entry site during the first two months. No prophylactic antibiotics were used and there were no reports of entry site infections; however routine swabbing of the entry site grew methicillin resistant staphylococcus aureus in six patients. Eight of eleven (73%) patients had the same tube for longer than two years.

The number of PEG being inserted has stopped rising and may be falling for patients with a CVA, but rising for surgical patients. CVA are the most common reason for PEG insertion. Long-term survival is best in patients after trauma or about the time of ENT surgery. Nine gauge PEG rarely have local problems and may last for two years.

Home parenteral nutrition training: A comparative study of cost effectiveness and quality of life issues between hospital and community. By J. VARDEN[1], A. MYERS[1] and T. CATLING[2], *[1]Intestinal Failure Unit, Hope Hospital, Salford M6 8HD and [2]Pharmacia & Upjohn Limited, Davy Avenue, Knowlhill, Milton Keynes MK5 8PH*

It has been suggested that patients make a quicker recovery within their home environment (Montgomery, 1993). This supports the emphasis placed by the government upon community rather than hospital-based care (Department of Health 1989). Within the Intestinal Failure Unit (IFU) at Hope Hospital, as in every other hospital ward in the country, it is of paramount importance that patients are discharged home safely at the earliest possible opportunity. It could be argued, however, that the discharge of these intestinal failure (IF) patients needs to be expedited more than most. Quite often, these patients have been in more than one hospital for several months or even years, are many miles away from home and loved ones, and are coping with the pressure of acute on chronic illness.

In the last 12 months 57 % of new referrals to the IFU have been discharged home on parenteral nutrition (PN). As if this in itself is not enough, the disabilities that often go hand in hand with IF such as high-output stomas, profuse diarrhoea and pain can make discharge home fraught with problems. However, many patients are able to achieve a good quality of life (Lennard-Jones & Wood, 1985; Scott et al. 1991), but only with training in the techniques of PN, the careful management of their underlying disease, an ongoing clinical support programme and a well-organized system for the provision of nutrient fluids and equipment (British Association for Parenteral and Enteral Nutrition, 1995).

It is the training of the patient to care for his/her own central line and administer fluids/nutrients that can prolong the patient's stay in hospital, once s/he is well enough to begin the training programme.

The present study describes the cost effectiveness and quality of life issues pertaining to training IF patients in hospital, compared with an earlier discharge into the community under the care of district or industry nurses.

Number of patients relating to different training methods

METHOD OF TRAINING	% OF PATIENTS
In hospital	93%
Cared for by district nurses	4%
Homecare Company	3%

Perhaps unsurprisingly, the cost of training a patient in hospital is much greater than when this happens in the community, irrespective of whom is doing the training. However, patients should be viewed as individuals with individual needs and the innumerable variables which can affect how and where a patient is trained, plus the quality of the care, make the decision to be taken much less straight forward and clear cut than may be anticipated.

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Is the impact of a nutrition support team on catheter-related sepsis sustained in the long term?

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As well as being a potentially life-saving treatment parenteral nutrition (PN) is an expensive and potentially dangerous therapy. The most common complication during PN is catheter-related sepsis (CRS). The national average is as high as 27 %. The introduction and implementation of formal protocols for intravenous catheter care through a nurse specialist within a nutrition support team (NST) are known to reduce this value from 27 to 2.5 % (Lennard-Jones 1992).

A 10-week survey was undertaken (October-December 1995) to assess PN management of adult patients and CRS within the Norfolk and Norwich NHS Trust. The CRS was shown to be 15 % and recommendations were made: for PN to be managed by a NST; for implementation of protocols and an education programme by the nurse specialist; formulation of agreed standards and an annual audit programme to determine whether a NST leads to a sustained improvement in the long-term.

A NST commenced in March 1996 with protocols and education programmes being implemented at the same time by the nurse specialist with standardization of equipment and a peripheral PN line insertion service.

	Survey 1995	Audit 1996	Audit 1997
No. of patients	30	20	23
Intravenous catheters	38	25	29
Duration of PN:			
median (d)	5	7	6
range (d)	1-23	2-39	1-12
CRS:	5 cases		1 case
% of patients	15	0 cases	4
% of catheters	13		3

Two 10-week audits subsequently took place (October-December 1996 and 1997) after the survey to assess the impact of changes made in PN management. The Table shows that the number of patients receiving PN following commencement of the NST fell, partly due to a reduction in inappropriate feeding. CRS within this Trust has been reduced considerably leading to a much higher quality of patient care along with substantial cost savings.

The impact of the NST on CRS is in line with audits undertaken in other centres, though it is acknowledged that further annual results are needed to ascertain the impact of the NST in the longer term, as shown by other NST (Payne-James *et al.* 1995). It is important for the continued existence of the NST and individual members that regular audit programmes are undertaken in today's financial and quality climates.

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The prevalence of malnutrition in patients admitted to Care of the Elderly wards.

By JOANNE L. WATSON, *Department of Nutrition and Dietetics, Guy's and St Thomas' Hospital Trust, Lambeth Palace Road, London SE1 7EH*

It is generally accepted that malnutrition is prevalent in 40 % of hospital admissions and is especially high among elderly patients (McWhirter & Pennington, 1994). As part of highlighting this issue to hospital staff, this study examined the prevalence of malnutrition among patients admitted to the four Care of the Elderly wards in a teaching hospital in south London. All consecutive admissions to this department, over a period of 4 weeks, were included. Where possible, anthropometric measures (weight, height, mid-arm circumference and triceps skinfold (TSF)) were collected within 2 d of admission, according to accepted techniques. Weights were adjusted accordingly if oedema or ascites was present. BMI and mid-arm muscle circumference (MAMC) were then calculated. In patients who were unable to stand, demispan was used to calculate height. Patients were also asked to report any history of unintentional weight loss in the previous 6 months.

In all, 101 patients were admitted during this time, with an average age of 80.3 years and with a male: female ratio of 2:3.

Table 1.

	BMI (*n* 65)			MAMC (*n* 78)	
	<16	>16-<18.5	>18.5-<20	<5th centile	5-10th centile
Proportion of patients (%)	3.1	12.3	13.9	25.6	11.5

Of patients admitted 18.8 % could not be weighed and 16.8 % were transferred, discharged or had died soon after admission and before the investigator could include them. Therefore, a high proportion of admissions (35.6 %) were not able to be included in this part of the study. In practice, including every patient is very difficult. Of patients able to respond, 52.3 % reported a recent, unintentional weight loss of >10 %. However, this relied on the patient's memory and is open to error.

Patients were defined as undernourished if they had a BMI<20 kg/m^2 and a TSF or MAMC <10th centile (Bishop *et al.* 1981).

Table 2.

	n	%
Undernourished	17	26.2
Normally nourished	26	40.0
Overweight (BMI≥25)	22	33.8

The prevalence of malnutrition of patients on admission to Care of the Elderly wards is not as high as found in the study of McWhirter & Pennington (1994) where 43 % were found to be undernourished. This may be due in part, to the slightly different definition used. However, it is still high enough to be a great concern to those caring for these patients. Also, centile charts for MAMC, TSF and MAC are not readily available for the elderly (>75 years) British population and this makes analysing anthropometry difficult.

Bishop CW, Bowen PE & Ritchey SJ (1981) *American Journal of Clinical Nutrition* **34**, 2530-2539.

McWhirter JP & Pennington CR (1994) *British Medical Journal* **308**, 945-948.

Perception of supplementary sip feeds given to patients by nursing assistants working in a variety of settings in Northamptonshire. by MABEL BLADES* Nene College, Northampton.

Malnutrition has long been recognized to be a common problem in patients in Hospital in the UK (Hill et al, 1977), it is also seen among patients in residential and nursing homes and in the community. The provision of meals and assistance with eating them should be a vital part of all nursing care (Henderson, 1969). Such tasks are often delegated to care assistants employed in hospitals, care homes or community settings. Patients identified as at nutritional risk are often recommended to be given nutritional supplements by a state-registered dietitian.

Encouragement to eat or take a supplement can have a profound effect on the patients compliance to do so. The present study aimed to ascertain the view that care assistants had of patients acceptance of supplementary nutrition.

A questionnaire was given to eighty undergraduate nursing students attending Nene College Northampton. All students were employed as care assistants at the time of undertaking training and completing the questionnaire. A number of students had also been employed as care assistants in other care settings in the past and therefore had seen the use of supplements in a number of settings.

All eighty students completed the questionnaire and all had seen the use of supplementary sip feeds with patients.

Of the eighty students, forty-two (52 %) had seen them used by patients in hospital, forty (50 %) had seen them used by patients in care homes and residential home settings and twenty-eight (35 %) with individual patients residing in their own homes who received support from community nursing services. There was a great variation in response to questions about supplementary sip feeds. Of the eighty students, twenty-six (32 %) felt patients did not like the sip feeds, twenty seven (33 %) felt that the patients enjoyed the sip feeds and twenty eight (35 %) thought that the response of patients was extremely variable with some liking them and others not enjoying them at all and refusing them.

When asked why the students thought patients responded to supplementary sip feeds as they did fifteen (19 %) students said they thought that the supplementary sip feeds were disgusting. All of these students who responded in this way had also found that the patients did not like the feeds. The remainder of students gave a wide range of replies.

This study showed a wide variety of responses to supplementary sip feeds by student nurses who were employed as care assistants .

It is of concern that student nurses who were employed as care assistants responded so adversely in some cases to supplementary feeds and it is of concern that this adverse impression of such products may be given to patients.

It would seem that this is an area both for more research and for the provision of more education on the subject to student nurses and care assistants.

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Dietary intake of adults, with and without pressure sores, treated by community nursing staff.
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Nutritional status and dietary intake have been associated with the development and healing of pressure sores (Osterweil, Wendt, Ferrell, 1995). Much of the research undertaken has been in the hospital setting. Little work has examined the dietary intake and nutritional status of community-living individuals with, or considered at risk of pressure sores. The present study aimed to examine dietary intake and factors affecting intake of community-living individuals, with and without pressure sores.

Patients, with (*n* 75) and without (*n* 100) pressure sores, receiving community nursing services, were randomly selected. Both groups were considered to be at risk of pressure sore development. A 24 h dietary intake recall method and a questionnaire examining intake and factors affecting intake were used. Initially participants were asked to complete 7 household measures dietary records; however, in practice, this proved impossible. Eighty-four 24 h records and 175 questionnaires (nutritional history) were completed. Participants were predominantly older adults (mean age 70 years sd 6).

When participants were divided into four groups on the basis of their protein intake, estimated from 24 h recall, a greater proportion of patients with pressure sores were in the group with the lowest protein intake ($P<0.05$). Intakes of other nutrients were not statistically different between groups. Mean energy intake fell below the estimated average requirement (Department of Health, 1991). Dietary intakes of many nutrients was similar to the reference nutrient intake, however, intake varied, with some individuals having very low intakes. The questionnaire showed that a greater number (17 %) of participants who required help with feeding had pressure sores ($P<0.01$). However, there were no significant differences between groups in the number who required help with shopping and cooking. More participants with pressure sores (17 %) had experienced recent taste changes ($P<0.05$). Nearly 30 % of all participants had experienced recent weight loss.

In conclusion, participants with pressure sores appeared to have a poorer dietary intake in some respects. A several participants (with and without pressure sores) had poor dietary intake and other risk factors for malnutrition present. Basic assessment of nutritional intake and status by community nurses could identify those patients with, or at risk of, malnutrition, so that an appropriate plan of care can be formulated. Some difficulties were encountered in the recording of dietary intake. Further assessments of dietary intake and anthropometric indices of those receiving community nursing services should be undertaken to support these results.

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Audit of General Practitioner's GP knowledge of and satisfaction with the service provided by the nutrition support team to patients at home receiving artificial nutrition. By CAROLE-ANNE McATEAR , *Department of Nutrition and Dietetics, Victoria Infirmary NHS Trust, Glasgow G42 9TY*

The nutrition support team (NST) at the Victoria Infirmary provides an outreach service to patients discharged from the hospital on artificial nutritional support. The main services it provides are:

1) nutrition clinic;the team reviews patients 3 monthly at a specific nutrition clinic in the hospital (Elia,1994);
2) domicillary visits; these are provided in cases of emergency or when the patient is too unwell to attend the nutrition clinic (Elia,1994);
3) helpline; patients are given a telephone contact number and are able to contact a member of the team 7 d/week 09.00-17.00 hours. Out of hours patients details are held on surgical wards where trained staff are available to advise in cases of emergency (Elia,1994; McAtear & Wright 1996);
4) 'Hospital to Home'; the NST liase with the GP and a commercial company to provide a delivery service directly to the patients home (McAtear & Wright 1996);
5) written information about the patient and their feeding, and a standard letter outlining the procedure for prescribing are sent to the GP and district nurse at the time of each patients discharge (Elia,1994; McAtear & Wright 1996);

The purpose of the present audit was to assess GP knowledge of and level of satisfaction with the services provided by the NST. Forty-Two GP were identified from the British Artificial Nutrition Survey (BANS) register as having been involved within the last 12 months with the discharge of a patient from the Victoria Infirmary to receive artificial nutrition at home. A questionnaire was designed and sent with a return stamped addressed envelope to these GP.

The response was good, thirty-three (80%) questionnaires were returned. However five GP returned blank forms for patients who had stopped feeding therefore only twenty-eight (66%) were collated.

- Thirteen (46%) GP were aware of services provided by the NST: nutrition clinic, domicillary visits and telephone helpline.
- Eighteen (66%) GP were aware of the 'Hospital to Home' delivery service provided by the commercial company.
- Eighteen (66%) GP confirmed that they had received written information at the time of the patients discharge.All of those who responded had found it useful. Six (33%) stated it was helpful and twelve (67%) stated it was very helpful.
- Twenty (72%) confirmed that they had received a standard letter outlining the procedure for prescribing.
- Overall the service was rated well: excellent *n* 12 (42%) satisfactory *n* 13(46%) no comment *n* 3(10%).
- Sixteen (60%) GP would like more information about artificial nutrition support at home: fifteen (68%) at the time of individuals discharge, two (9%) as a general written information pack and five (23%) in the form of study days/evenings.
- In the area for free text the information requested was more detailed discharge letters and more information about who to contact in an emergency or for general advice.
- Twenty-six (93%) thought that it was very important/important that the care of these patients was shared between acute services and primary care.

The high response rate and requests for further information on artificial nutrition at home indicate that this is an area of interest to GP. The GP are mainly satisfied with the services; it appears to be communication of their availability that needs to be improved.

The NST plan to redesign their written information discharge package in an effort to improve communication and market the service. However before embarking on this it would be beneficial to carry out a similar audit on the other main users of the service the patients and their carers and district nurses, in order that their requirements can be incorporated at the same time.

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McAtear C & Wright C (1996) *Dietetic Standards for Nutritional Support.* Birmingham: British Dietetic Association.

A cross-sectional study of nutritional outcomes after percutaneous endoscopic gastrostomy (PEG): results and problems of assessment. By E. BANNERMAN[1], J. PENDLEBURY[1], F. PHILLIPS[2] AND S. GHOSH[1], [1]*Nutrition Support Team,Gastro-intestinal Unit and* [2]*Department of Dietetics and Nutrition, Western General Hospital, Crewe Road, Edinburgh EH4 2XU*

A recent study of long-term home enteral nutrition feeders (both PEG and naso-gastric feeders) identified protein-energy malnutrition and micronutrient deficiencies (McWhirter *et al.* 1994). Currently, in Lothian, there is minimal clinical community dietetic cover, consequently many patients are discharged from hospital with no opportunity for follow-up. There is concern regarding the lack of monitoring of a significant proportion of patients. The current paper presents data on the nutritional status of a cohort of patients in Lothian followed-up (median time 15.7 months) after PEG placement.

Details of patients assessed have previously been described (Bannerman *et al.* 1997). Fifty-five patients (thirty-two still feeding via the PEG and twenty-three who had resumed oral intake) underwent a complete nutritional assessment. The following assessments were considered and carried out depending upon the patient's abilities: weight (kg), height (m), knee-height (cm), mid-upper-arm circumference (cm) and triceps skinfold thickness (TSF; mm). From these measurements the following indices were calculated: BMI (kg/m^2) (using either height or estimated stature from knee-height), arm-muscle circumference (AMC) and correced arm-muscle area (CAMA) (cm^2). A non-fasting blood sample was taken to assess status of micronutrient, namely: Mg, Zn, Se, Cu, vitamins A, D and E along with total protein, albumin and various haematological variables as were assessed in the previous study (McWhirter *et al.* 1994).

Weight measurements were obtained in thirty-two (58 %) patients. Height measurements were obtained in eighteen (33 %) patients whilst an estimate of stature was obtained in forty-one (75 %) patients. Upper-arm anthropometry was performed successfully on fifty-two (95 %) patients. Nine patients (16 %) were considered to be undernourished as determined by BMI $\leq$20 kg/m^2 (five were still feeding via the PEG, four had resumed oral intake); two 'severely undernourished', BMI <16 kg/m^2, one 'moderately undernourished' BMI 16 - 18 kg/m^2 and six 'mildly undernourished' BMI 18 - 20 kg/m^2 (of which four had resumed oral intake). Using a CAMA $\leq$ 16.0 cm^2 and $\leq$16.9 cm^2 (males and females respectively) it was seen that three patients (5%) were identified as malnourished. All these patients were still feeding via the PEG. The commonly adopted <10th centile of age and sex-specific reference data for AMC and TSF was used to identify individuals with under-nutrition. In total 41 % were considered to have protein-energy malnutrition, as compared with 57 % in the previous study (McWhirter *et al.* 1994).

In terms of micronutrient biochemical depletion, three individuals had low 1,25-dihydroxycholecalciferol levels (<15 μmol/l) (all were >65 years old and two had resumed oral intake), two individuals had depleted vitamin A levels (< 1.0 μmol/l) whilst no individual showed vitamin E biochemical deficiency. No individual showed signs of anaemia, or Mg or Cu biochemical depletion. Ten individuals had depleted serum Zn concentrations (<11 μmol/l) whilst serum Se concentrations were below normal (<0.8 μmol/l) in five individuals (two still feeding via the tube, three who had resumed oral intake). In summary, 53 % of individuals presented with biochemical evidence of micronutrient deficiency.

This study illustrates the difficulties in nutritional assessment of this group of patients. Many are either bed-bound and/ or have severe physical disabilities. Many are unable to attend the outpatient clinic, thus equipment available to assess such patients is limited. The ability to perform upper-arm anthropometry on 95 % of the patient group would suggest this may be a more useful method of assessment compared with weight and height measurements. Considering the lack of formal dietetic monitoring of this group of patients the number of patients who presented with nutritional problems was lower than anticipated and previously reported (McWhirter *et al.* 1994). Suggestions for the differences seen include, differences in the nutrient-density of the feed patients were receiving and all patients in the current study being fed via the PEG.

Bannerman E, Pendlebury J, Phillips F. & Ghosh S (1997) *Gut,* **41,** Suppl. 3, A90.

McWhirter JP, Hambling CE and Pennington CR (1995) *Clinical Nutrition* **13**, 207-211.

An audit of prescribing patterns of oral nutritional supplements in primary care. By MURIEL J. GALL[1], JULIETTE E. HARMER[2], HEATHER J. WANSTALL[1] and ANNMARIE J. RUSTON[3], [1]*Department of Nutrition and Dietetics, Joyce Green Hospital, Dartford DA1 5PL,* [2]*Department of Nutrition and Dietetics, East Surrey Hospital, Redhill RH1 5RH,* [3]*Centre for Health Services Studies, University of Kent, Canterbury CT2 7NF*

In West Kent a 40 % increase in prescribing of oral nutritional supplements in Primary Care has been observed in the last 5 years, indicating increasing recognition by Primary Care health professionals of the need to treat malnutrition. However, it is known that other interventions such as dietary counselling (Murphy *et al.* 1992) and fortifying meals (Ödlund Olin *et al.* 1996) can increase nutritional intake. We therefore wished to know how patients were selected for supplements, what dietary advice was being offered and if supplements were being used effectively.

Volunteer general practitioner (GP) practices were recruited to the project and the GP, district nurses (DN) and practice nurses (PN) were asked to complete a questionnaire.

In all, 170 GP were recruited from forty-three practices and questionnaires were completed by 117 GP (a 69 % response rate, representing 23 % of the total GP population in the study areas). Sixty-six DN and twenty-seven PN also completed questionnaires. Data from PN were insufficient to report on as the majority considered they did not see this client group and that the questionnaire was not relevant to them.

No GP said they used a nutritional screening tool compared with 12 % DN. The nutritional screening tools used by DN were Prideaux 2 %, Nutrition Risk Score (Reilly *et al.* 1995) 3 %, and Screening in Practice (Abbott Laboratories, 1996) 8 %. Only 19 % of GP and 70 % of DN reported that they would offer dietary advice to this client group either before, or when commencing, oral nutritional supplements. The main dietary advice offered was "eat little and often" which was advised by 8 % of GP and 23 % of DN. Of the DN 20 % reported that the dietary advice offered was to "take the supplements". When asked if any of the following monitoring was undertaken, 19 % and 48 % (GP and DN respectively) reported weight; 33 % and 80 % reported appetite and 28 % and 67 % reported weight change was checked. When asked what they would describe as appropriate reasons for prescribing supplements: 75 % and 85 % (GP and DN respectively) reported terminal illness; 45 % and 14 % loss of appetite; 52 % and 33 % weight loss and only 29 % GP reported wound healing as a reason to prescribe supplements compared with 77 % of DN.

These findings demonstrate that a nutritional screening tool is seldom used by GP and DN and that the majority of GP and DN think that terminal illness is the main criterion for prescribing supplements. GP do not appear to recognize wound healing as a criterion for prescribing supplements. Inadequate dietary advice is offered to patients by primary healthcare professionals and little monitoring is undertaken, which may result in supplements being prescribed needlessly on repeat prescriptions in the long term.

We therefore suggest that widespread education of GP, DN and PN is required in the areas of: nutritional screening; first line dietary advice either before, or when commencing supplements; monitoring; and in highlighting the role of the dietitian for this client group. These measures, if implemented by Primary Care staff, could lead to improved nutritional management of the patient and more cost-effective prescribing of supplements.

Murphy J, Cameron DW, Garber G, Conway B & Denommé N (1992) *Journal of the Canadian Dietetic Association* **53**, 205 - 208.

Ödlund Olin A, Osterberg P, Hadell K, Armyr I, Jerström & Ljungqvist O (1996) *Journal of Parenteral and Enteral Nutrition* **20**, 93 - 97.

Prideaux Nutrition Screening Tool Prideaux R, unpublished data

Reilly HM, Martineau JK, Moran A & Kennedy H (1995) *Clinical Nutrition* **14**, 269 - 273

Screening in Practice, Nutrition Screening Tool, (1996) Abbott Laboratories

The evaluation of a triacylglycerol (TAG) analysis in gastric aspirates as a measure of gastric emptying in critically ill patients. By LYNDA PARKE[1], JOAN MARTYN[2], CATHERINE O'MALLEY[1], KATE YOUNGER[2], JOHN TIGHE[2], and KIERAN CROWLEY[1], [1]*St Vincent's Hospital, Elm Park, Dublin 4, Ireland,* [2]*Department of Biological Sciences, Dublin Institute of Technology, Kevin St., Dublin 8, Ireland*

Currently, the volume of gastric aspirates is used to decide whether or not enteral feeding is being tolerated in critically ill patients (intolerance is diagnosed when aspirate volumes of > 200 ml have been obtained after two successive 4 h feeding periods). This is not necessarily an accurate estimation, however, since it does not distinguish between the volume of feed or gastric juices remaining in the stomach (McClave & Snider, 1991). The first aim of the present study was to evaluate the suitability of a serum TAG kit for analysing TAG concentrations in gastric aspirates. The second aim was to compare the TAG analysis method with the traditional volumetric method in measuring the extent of gastric emptying in critically ill patients.

The serum TAG assay (Boehringer Mannheim GPO-PAP) was evaluated and proved to be suitable for analysis of gastric aspirates and enteral feed (Osmolite, Abbott Lab.) based on linearity, sensitivity, within- and between-run precision and recovery studies. Twelve patients in the intensive care unit were commenced on nasogastric feeding according to the in-house feeding protocol. Gastric aspirate samples were collected for TAG analysis every 4 h (samples were taken after total aspirate volume measured) until the final recommended rate of administration of feed was reached. The volumes of feed and fluid administered were recorded for each 4 h feeding period, as were total volumes of gastric aspirates and volumes of gastric aspirates returned to the patients. By knowing the volumes of both feed administered and the gastric aspirates and their TAG concentrations, retention of TAG and hence feed (i.e. gastric emptying) by the patient could then be calculated by difference. Retention (RET) was taken as the percentage of feed administered that was retained, and this value is shown in the Table, calculated both on the basis of volume and of TAG concentration for the thirteen patients. Total time for which measurements are shown varies, i.e. 18-84 h, and this is due to the longer collection periods required for some of the intolerant patient group.

	Tolerant Patients							Intolerant Patients					
	1	2	3	4	5	6	7	8	9	10	11	12	13
Time (h)	27	25	19	20	30	28	40	23	18	38	84	20	69
RET by TAG(%)	88	95	99	99	99	98	82	-5	-53	46	46	2.5	53
RET by Vol. (%)	71	91	99	92	96	96	70	8.5	67	60	-13	-62	36

Of the thirteen patients, seven tolerated the feed well, with percentage RET that was slightly, but significantly ($p < 0.05$, paired t test) greater by TAG than by volume. However the remaining six patients were less tolerant, and in several (11,12,13) it is clear that the volumetric method of assessing tolerance underestimated (though not statistically significantly) the amount of feed actually retained by the patient according to the TAG concentration method. In these cases the reduction of feed delivery due to a diagnosis of intolerance would appear inappropriate. The lower percentage RET of TAG *v.* volume in the other three patients may be due to increased water absorption from the stomach, resulting in an increased TAG concentration which was greater than the TAG content of the feed given. In conclusion, TAG estimation in gastric aspirates is a viable assay and may provide more reliable information on the retention of enteral feed than volumetric measurements alone.

Mc Clave SA & Snider HL (1991) *Journal of Parenteral and Enteral Nutrition* **16**, 99-105.

Performing some simple anthropometric measurements on residents in nursing homes: how practical is it? By VERA TODOROVIC[1], ANN MICKLEWRIGHT[2], MARK MYATT[3] and HILARY KEMP[1], [1]*Dietetic and Nutrition Services, Bassetlaw Hospital, Worksop, S81 OBD,* [2]*Dietetic and Nutrition Services, Queens Medical Centre, Nottingham NG7 2UH,* [3]*Brixton Health, Llanidloes. SY18 6EB*

Individuals who are institutionalized in nursing homes are potentially at nutritional risk since many may have physical and mental health problems which can interfere with adequate nutritional intake (Posner *et al.* 1993).

In order to promote action by any care worker in a nursing home for the prevention of nutritional crisis, simple and practical assessment tools need to be used.

The aims of this study were to assess whether ongoing simple nutritional assessments using anthropometric tools were already being made in nursing homes, to provide care workers with additional tools to help with the assessment process and to identify problems that staff encountered when performing these measurements.

Thirteen nursing homes across Nottinghamshire participated in the study (403 clients, 7 % of nursing home population). The client group included a number of elderly mentally ill (51 clients, 13 % of study population).

Measurements used were height, weight, demispan and mid upper arm circumference (MUAC). Body Mass Index (BMI) and MUAC were considered to be useful simple tools to use as changes in values can act as predictors of mortality (Kwok & Whitelaw 1991; Falciglia *et al.* 1998. The measuring tools selected had to be non-resource- intensive for the nursing homes, be easy to use by any care worker in the home and measurements had to be quick to perform. A subjective assessment of mobility was also included and carried out by the nursing home staff. Principal and secondary clinical diagnoses were also collected.

Twenty nurses and carers from the participating nursing homes attended a training workshop where they were taught by dietitians to undertake the various anthropometric measurements. These individuals were then responsible for carrying out one full set of measurements on all their nursing home clients and returning the data for analysis.

The study population comprised 103 (29 %) males and 257 (71 %) females (n = 360) aged between 45 and 103 years with a mean age of 84 years (n = 287). The mean length of time in the nursing home for clients was 26 months.

The availability of anthropometric measurements varied according to the measurements performed.

Measure	n	Percentage	95 % CI
Height	94	23.3	19.3, 27.8
Weight	372	92.3	89.1, 94.6
Demispan	281	69.7	64.9, 74.1
MUAC	283	70.2	65.5, 74.6
BMI from height	88	21.8	18.0, 26.3
BMI from demispan	272	67.5	62.6, 72.0
Weight measured at admission	317	78.7	74.3, 82.5

It was not possible to obtain a weight or MUAC measurement in only 5 % of clients. In 68 % cases (n = 199) individuals had their weight measured within 2 months of their last weighing. Clients with BMI <20 kg/m^2 overall gained weight from time of admission to nursing home and those with BMI 20-30 kg/m^2 remained stable. The main problems relating to the measurements included the difficulty in checking a client's height, access to arm and armspan for MUAC and demispan measurements. Staff favoured weight and MUAC as anthropometric measures of choice.

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Continuous audit of percutaneous endoscopic gastrostomy for long-term enteral nutrition. By J.P. BAXTER, J.M. TAIT and C.R. PENNINGTON, *Department of Digestive Diseases and Clinical Nutrition, Ninewells Hospital and Medical School, Dundee DD1 9SY*

It is accepted that the optimum provision of long-term enteral nutrition is via percutaneous endoscopic gastrostomy (PEG). Long-term follow up of patients with PEG tubes is an important aspect of their optimal management. Patient selection and long-term monitoring had been identified as problem areas. Appointment of a nutrition support coordinator (NSC) and nurse specialist (NS) in gastroenterology, and revision of our own protocols for patient selection and management and their implementation were considered possible solutions.

The aim of the present audit was to assess current practice with regard to patient selection and tube-related problems, and to identify the demands placed on the gastroenterology service by analysing follow-up data on all PEG tubes inserted in the gastroenterology unit of Ninewells Hospital.

Between November 1991 and May 1998, 262 PEG tubes were placed in 206 patients, ninety-four (45.6 %) male, 112 (54.4 %) female. The mean age was 62.5 (range 16-93) years. All of these patients had follow up of more than 31 d. Patient days studied were 56 367, the mean duration of PEG feeding was 273 (range 1-1095) d.

Patient diagnoses included cerebrovascular disease (53.1 %), multiple sclerosis (9.2 %), motor neurone disease (7.3 %), cerebral palsy (7.6 %), persistent vegetative state (3.8 %), malignancy (8.0 %) and malnutrition of other aetiology (11 %). Data were analysed in relation to patient survival and tube survival. Statistical analysis was carried out using the Kaplan-Meier procedure.

Twenty-four (12 %) patients resumed oral diet, fifty-three (25.7 %) continued PEG feeding, 116 (56.3 %) died (mean 158.3, range 3-970) and follow-up data were not available on thirteen (6.3 %). As cerebrovascular accident was the single largest diagnosis category, survival data on stroke and non-stroke patients were compared. At 31 d, the survival rate of stroke patients was 85.6 % (mean survival 351.21 d) compared with a non-stroke survival rate of 90.5 % (410.18 d) (P=0.279).

A total of 183 patients had only one tube while twenty-three patients had subsequent replacement tubes (mean 3 per patient, range 2-8). The mean survival time for these tubes was 316 (range 3-1095) d. The reasons for non-elective replacement were infection (n=17); blockage (n=6); leaking (n=6); perished (n=16) and accidental displacement (n=22). Eleven patients had tubes removed for elective placement of low profile devices, five of which continue. Forty-seven balloon gastrostomy tubes were used as replacements in twenty-one patients (one to six per patient), sixteen of which continue. The mean survival of these tubes was 71.9 (range 1-210) d. In three patients, balloon gastrostomy tube displacement was such a significant problem that elective replacement of a PEG was carried out.

In addition to 123 tube placements, there were 141 post-insertion consultations in the past 2 years. Previously this work, including screening of referrals, insertion and management procedures was carried out by medical staff. The need for increased resources in this area was recognized and subsequently led to the appointment of the NSC and NS. These duties as well as long-term follow-up and training and education are now carried out by the NSC and NS. Improved education of staff has led to a reduction in demands on secondary care input. The annual referral rate would appear to have reached a plateau of fifty-five. Early deaths are few and complications are minimized by the implementation of protocols.

Audit of the service to these patients is continuous to ensure appropriate procedures and minimize the risk and complications associated with this procedure.

An audit of growth rate for infants on the neonatal unit, Children's Hospital, Leicester Royal Infirmary NHS Trust. By SARA MCDOWELL, *Children's Dietitian, Leicestershire Nutrition and Dietetic Service, Fosse Health NHS Trust, Leicester LE5 0TD*

Twice weekly measurements of weight of each infant on the neonatal unit are the only consistent measurements taken to monitor their growth. Consecutive audits were carried out to identify and evaluate the growth rate of infants on the unit in October 1995, April 1996 and March 1998. A standard weight gain of 15-18 g/kg/ body weight per d was used (Lubchenco, 1963) for infants under 2 kg body weight and a standard of 30 g body weight daily for infants over 2 kg body weight. Length of cot stay and whether the patient was reviewed by a dietitian were also recorded.

Weight gain, and therefore growth rate (Bishop *et al.* 1990), was calculated for each individual infant using first recorded weight after day 8 of admission and last recorded weight pre-discharge. Factors such as use of dexamethasone, the infant's clinical condition and use of parenteral nutrition (PN) were also recorded for each infant. Any infants on dexamethasone were excluded from the audit. The results are shown in the Table.

Group	Overall mean weight gain		Dietetic involvement	Mean length of stay	Mean weight gain with dietetic involvement				Mean weight gain with no dietetic involvement			
	< 2 kg (g/kg per d)	>2 kg (g/d)	(%)	(d)	<2kg (g/kg per d) Mean	SD	>2kg (g/d) Mean	SD	<2kg (g/kg per d) Mean	SD	>2kg (g/d) Mean	SD
Oct 1995 (sample 1)	18.1	24.2	9 $n = 33$	18.7	13.4	12.80	31.6	-	19.1	6.61	24.2	24.73
Apr 1996 (sample 2)	13.8	22.6	14 $n = 35$	20.5	19.2	6.90	45.2	43.80	15.5	6.80	18.5	21.40
Mar 1998 (sample 3)	14.4	17.3	36 $n = 44$	25.3	9.4	6.21	12.7	38.83	12.1	8.50	-0.1	9.34

All groups had an overall growth rate below the standard used except the babies less than 2 kg in the October 1995 group. All groups had similar distribution of clinical conditions with the majority of each sample group on enteral nutrition (sample 1, 15 % on PN; sample 2, 12.5 % on PN; sample 3, 23 %). Length of cot stay did not appear to be influenced by growth rate. This may be because all the factors influencing growth were not eliminated in the surveys and because of the limitation of using weight gain alone as an assessment of growth. Regular length measurements are a strong recommendation of this three-pronged audit. However, dietetic input does have a positive effect on growth outcome. Using the two-tailed test it can be seen that dietetic involvement leads to significantly increased weight gain. The higher incidence of dietetic input in the latter sample can be explained by the instigation of the Leicestershire-wide "Enteral feeding guidelines for all health professionals working with neonates". A further audit is planned in 1 year's time to reassess weight gain and growth of these infants.

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Lubchenco LO (1963) *Paediatrics* **32** 793-800.

An evaluation of estimating patients weights as an accurate method when compared with actual weight. By CAROLE-ANNE McATEAR, *Department of Nutrition and Dietetics, Victoria Infirmary NHS Trust, Glasgow G42 9TY*

Table 1 below shows the results from audits of the number of patients weighed before referral for dietetic intervention.

Table1

Date	Total number referred	Weighed	Not weighed
March 1995	52	12 (23%)	40 (77%)
September 1995	41	11 (27%)	30 (73%)
January 1997	54	15 (27%)	39 (73%)
November 1997	37	21 (57%)	16 (43%)

The improvement in November 1997 was attributed to a trust education programme organized by the Department of Nutrition and Dietetics. The audit demonstrated that even under optimum conditions the most you can hope to achieve is a weight for two-thirds of patients.

To calculate patients estimated requirements for energy it is recommended (Todorovic & Micklewright, 1989) to estimate their BMR using an equation (Schofield, 1985) that includes actual body weight. Actual body weight is also used to calculate patients requirements for fluids and certain drugs including anaesthetics. When asked, healthcare professionals within the trust stated that in the absence of an accurate patients weight for these calculations they used an estimated one.

The purpose of the present study was to evaluate the accuracy of this method of obtaining a patient weight and to determine whether the accuracy of the estimation was affected by the healthcare professional making the estimation.

For 100 in-patients, the members of the nutrition support team (NST) anaesthetist *n* 2, nutrition nurse specialist *n* 3, dietitian *n* 1 were asked to estimate the patients weight, the patient was then weighed and the estimate compared with the actual weight. Where possible *n* 74 the patients were also asked to estimate their own weight. To determine if there was a difference between individuals with a designated nutrition role and those without, the same process was then used on a smaller sample *n* 22 of in-patients with nurses (junior staff nurse to ward sisters) and doctors (junior house officers to consultant) outwith the NST.

The differences, in kg and as a percentage of actual weight, between the estimated weights and the actual weight of patients are illustrated in table 2 below. The results for each group of healthcare professionals and the patients are shown separately.

Table2

Group	*n*	mean kg(%)	median kg(%)	range kg(%)	SD kg(%)	95th percentile kg(%)	*P*
Anaesthetist	100	1.2 (3.2)	2.0 (3.2)	38 (76.8)	6.9 (13.1)	11.0 (24.5)	0.01
Dietitian	100	0.7 (2.2)	1.0 (2.2)	27.0 (56.3)	4.9 (9.6)	9.5 (20.9)	0.01
Nutrition nurse	100	0.4 (1.8)	0.5 (0.9)	31.0 (60.0)	7.6 (13.8)	13.0 (27.7)	0.01
Patient	74	-0.3 (-0.4)	0.0 (0.0)	38.0 (84.3)	4.8 (9.7)	6.0 (11.1)	0.01
Doctor	22	-1.5 (-0.9)	-2.5 (-3.6)	38 (65.3)	8.9 (15.4)	11 (22.5)	0.01
Nurse	22	-1.0 (-1.1)	-3.0 (-3.5)	13.0 (29.5)	4.2 (7.9)	7.0 (14.0)	0.01

These results show that there was a good correlation between actual and estimated weight ($P< 0.01$) in all groups that were asked to estimate. The 95 % confidence interval was less than 30 % which means that this is the maximum an estimate would be over/under.

In conclusion, in the absence of an actual weight it is possible to use a weight estimated by any of the healthcare professionals mentioned or the patient themselves in equations to estimate patients requirements, but it may be more appropriate to calculate a range of requirements taking into account the standard deviation of the estimates of each groups listed.

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Todorovic VE & Micklewright A (1989) ***A Pocket Guide to Clinical Nutrition.*** **Birmingham: British Dietetic Association,**

Attitudes of nutrition nurses to their role, to nutrition education and to relationships with dietitians.

By LYNNE SCOTT and ELIZABETH A. BELTON, *School of Food and Consumer Studies, Faculty of Health and Food, The Robert Gordon University, Queen's Road, Aberdeen AB15 4PH*

Malnutrition in hospitalized patients is still a common occurrence. The King's Fund report (Lennard-Jones, 1992) recommended the use of multidisciplinary teams to organize and co-ordinate effectively the nutritional support of patients. The aim of the present study was to investigate the role of nutrition nurses in the nutrition care team and their attitudes to nutrition education and relationships with dietitians.

A postal survey questionnaire was sent to all nutrition nurses who were registered with the National Nurses Nutrition Group (NNNG) in March 1998 (n 77). Forty-five questionnaires were returned giving a response rate of 58 %. Descriptive and frequency statistics were applied to quantitative and qualitative data.

The majority of respondents (89 %) worked as part of a nutrition care team and worked directly with individual patients as well as on an advisory basis. Their nutrition care teams included all the core members recommended by the British Association for Parenteral and Enteral Nutrition report (Silk, 1994). These were a clinician, nutrition nurse, dietitian and pharmacist. Other health professionals were included as required. Of respondents, 98 % perceived that the nutritional care of patients was improved by a team approach. The most frequent problems encountered by teams were the medical staff's lack of nutritional awareness, staff shortages and time constraints. The most common roles of the nutrition nurse were training of ward staff, patient and staff education, formulating policies and standards, and management of equipment. Of the nurses, 29 % thought that their role should include identifying patients who required nutritional support and choosing the most suitable route for the administration of nutritional support; 73 % thought that their role overlapped that of dietitians but that the roles complemented each other.

Areas of overlap	% of respondents
Nutritional assessment	41
Education of staff and patients	34
Monitoring patients receiving support	17
Selection of administration route	17

Nutrition education received during their nurse training was perceived to be poor by 38 % of respondents; 44 % of the respondents said that a state registered dietitian had not been involved in their nutrition nurse training.

This study indicates that the roles of nutrition nurses and dietitians overlap but are complementary and of benefit to the nutrition support team and patients. In conclusion, there is a need to improve both the provision and the quality of nutrition education and training of nutrition nurses and doctors.

We acknowledge the National Nurses Nutrition Group for their help in undertaking this survey.

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Silk DBA (editor) (1994) *Organisation of Nutritional Support in Hospitals.* Maidenhead: British Association for Parenteral and Enteral Nutrition (BAPEN)

Improved prescribing of parenteral nutrition following revision of standard available regimens.

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Although recent understanding has led to the use of reduced levels of parenteral nutrition (PN) in critically ill patients (Elia, 1995), we believe that over-feeding may still be a problem. In particular, we think that it should be avoided during any period of metabolic instability e.g. soon after major surgery, during systemic sepsis, or after prolonged under-nourishment. We therefore aim to commence PN in most patients at levels only matching resting energy expenditure (REE), especially as physical activity is usually very limited in such patients. More generous feeding for tissue repletion is then introduced a few days later, once metabolism has stabilized and micronutrient deficits are likely to have reversed. We estimate REE from BMR (Schofield, 1985) by adding a fixed 30 % to cover stress, fever and thermogenesis, a value supported by indirect calorimetry measurements of REE in twenty-seven post-surgical PN patients which correlated closely with the estimates (r 0.74). Individual measurements, however, ranged from -31 to +43 % of predicted.

Despite our concern about overfeeding, an audit of eighty-five early post-surgical PN patients showed that > 60 % had received >837 kJ/d more than estimated REE, with 36 % receiving an excess of >1674 kJ/d. This prompted an examination of the eight 'standard' PN regimens which we had used to prescribe for the majority of the patients, although some had received 'specials' compounded to meet unusual needs. Low N:energy ratios explained the propensity to over-prescribe energy and so changes were made to reduce energy levels to match measured REE. Simultaneously, the number of 'standard' regimens was also reduced to three.

	Regimens before review								Regimens after review		
No	1	2	3	4	5	6	7	8	1	2	3
g N/d	9.1	9.1	9.1	8.25	11.0	14.0	14.0	16.5	9.1	14.0	16.5
MJ/d	8.58	10.25	8.49	8.79	10.67	10.67	15.27	15.27	6.69	8.79	11.92

Following the changes a second audit in eighty similar post-surgical and ITU patients was performed.

Prescription relative to REE (kJ/d)	Before review (n= 85)	After review (n=80)
>1674 -	0 (0%)	4 (5%)
837 - to 1674 -	0 (0%)	9 (11%)
837 - to 837 +	33 (39%)	54 (68%)
837 + to 1674 +	21 (25%)	11 (14%)
>1674 +	31 (36%)	2 (3%)
Number needing 'Specials'	13 (15%)	4 (5%)

The decrease in overfeeding probably reflects, in part, our increased consciousness of over-prescription, but the data also demonstrate the influence that 'standard' available regimens have on prescribing habits. Following the changes, 16 % of patients were underfed by >837 kJ/d but we believe that a limited period of underfeeding during acute physiological stress is probably less harmful than feeding in excess. The fact that after reducing the number of standard regimens, only 5 % of patients needed 'specials' compared with 15 % before, suggests that only three 'standard' PN bags are required to match most patient needs.

Elia M (1995) *Lancet* **345**: 1279 - 1284.

Changing feeding practices in Intensive care 1996-1998. By ALISON. M. YOUNG, LIBBY JOHNSON and JANNETTE KIRKHAM, *Clinical Audit Department, Wythenshawe Hospital, Southmoor Road,Manchester M 23 9LT*

An audit carried out in 1996 looking at feeding practices on the Intensive Care Unit (ICU) revealed major problems in the provision of patients' nutrition during their stay. As a result of this audit a simple feeding protocol was introduced onto the unit. The aim of the audit was to compare feeding practices on ICU in 1996 and 1998. The objectives were to look at the routes of feeding used in ICU, to identify how effectively patient's energy requirements are met, to identify some of the problems that prevented full delivery of patients' energy requirements and to look at the action taken to overcome the identified problems. All patients on ICU for over 3 days were recruited. Energy requirements were calculated using the Schofield (1985) equation and Elia (1990) nomogram. A daily record was made of route of feeding, daily energy provisions from oral, enteral and parenteral nutrition and problems that prevented delivery of full volume of feed. The data were collected onto an access database and analysed in a Microsoft Excel spreadsheet.

Table 1. Patient details

Date...	1996	1998
No. of patients	27	31
Patients fed during their stay on ICU (%)	81	100
Feeds started by day 4 (%)	74	97

Table 2. Route of feeding

Route	1996	1998
TPN (%)	16	20
Enteral (%)	49	71
Oral (%)	6	5
Combination of routes* (%)	29	4

* Majority of combination feeds were TPN in 1996

Table 1 shows that overall a greater proportion of patients was fed, and that feeds were started sooner, in 1998. Table 2 shows that overall there is an increase in enteral nutrition and a decline in parenteral nutrition (TPN). These values are supported by stock values from pharmacy.

Table 3. Average energy intake of patients as a percentage of their energy requirements whilst on ICU

Average energy intake as a percentage of requirements	1996	1998
0-30 (%)	44	13
31-69 (%)	34	35
> 70 (%)	22	52

Table 3 shows that overall patients received a greater percentage of their energy requirements in 1998 than in 1996. The problems with the enteral route that prevented full delivery of energy requirements in 1998 included: gastric stasis, constipation, nausea, fluid overload, electrolyte imbalance, returns to theatre, extubation and abdominal distension. In contrast, TPN despite its increased risks to the patient was surprisingly problem free. The problems recorded included fluid overload and electrolyte imbalance.

Future developments for both the ICU and the trust include nutrition nursing care plans and input from the dietitian as part of the introductory protocol for all new nurses. Proposals have been tendered for the appointment of a nutrition specialist nurse.

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Schofield MN (1985) *Human Nutrition Clinical Nutrition* **44**, 1-19.

Nutrition in nurse education. CAROLYN DAVISON, *South Tyneside Health Care Trust, Harton Lane, South Shields, Tyne and Wear, NE34 OPL*

It is generally accepted that knowledge of nutrition is a fundamental aspect of professional nursing practice, yet there is increasing concern about ignorance of nutrition-related areas among practising nurses. Numerous reports have identified a serious problem of unrecognised malnutrition in UK hospitals which has significant clinical and financial consequences. A lack of knowledge and understanding, attributed to inadequate nutrition education and training have been blamed as the principle reasons for lack of progress in tackling the problem.

Meeting the nutritional needs of patients is a core nursing function. As patients continue to receive insufficient and/or inadequate nutrition, the role of the nurse has recently been under scrutiny by the public, the media and the Department of Health.

To address the issue of nutrition education and training within local nursing curricula, South Tyneside Health Care Trust, in partnership with the University of Northumbria at Newcastle secured commercial funding to second a Nutrition Nurse to the University on apart-time basis. The aims of the secondment were to examine the nutrition content of the pre-registration nursing curriculum, to participate in the education of relevant nutrition-related topics and to contribute to the development of nutrition components of pre and post registration nursing curricula.

This presentation identifies the nutrition content of the common foundation programme and the adult branch of the RN/DipHE programme, and relates the findings to British guidelines for nutrition education and training (DoH, 1994; English National Board for Nursing, Midwifery & Health Visiting, 1995). Findings demonstrated that, although the nutrition content is, on the whole, comparable with the guidelines, gaps did exist and the integration of nutrition themes was fragmented. These findings have been actively addressed by the University and curricula changes have evolved. The overall outcomes of the secondment are: (1) strengthened professional links between the Trust and University; (2) a higher nutrition profile within the educational agenda, with a greater nutritional awareness among teaching staff and students; (3) improved resources with a stronger evidence base; (4) a bridging of the theory-practice and the practice-theory gap; (5) informed curriculum development, providing a sensitive rationale for change; (6) increased nutritional knowledgel skill base of students.

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English National Board for Nursing, Midwifery & Health Visiting (1995) Nutrition for Life: Issues for Debate in the Development of Education Programmes. London: ENB.

Catering for elderly hospital patients: a study of food choice in hip-fracture patients and the selection of suitable foods for supplementation. By M. LUMBERS[1], M.C. MURPHY[2], V. BOWERS[2], A. PANAYIDOU[2], M.W.J. OLDER[3] and S.A. NEW [2], [1] *Centre for Food and Health Care Management, School of Management Studies for the Service Sector and* [2]*School of Biological Sciences, University of Surrey, Guildford GU2 5XH and* [3]*Department of Orthopaedic Surgery, Royal Surrey County Hospital, Guildford, GU2 5X*

Elderly hospitalized patients have been shown to have low intakes of energy and most other nutrients. Recent studies have found that not only were patients unable to consume all that was provided at normal meal times, but also even if all the food chosen from the menu had been consumed, only 60% of the energy requirement would have been obtained; furthermore nutrient intakes would still have fallen short of the reference nutrient intake for protein, folate, Ca, Fe and Zn, (Lumbers *et al.* 1998). The implication of this is that energy intake can only be increased by more frequent food provision using snacks as well as the fortification of normal foods.

The meal selection patterns of twenty-four elderly hip-fracture patients (mean age 80 years) were investigated to determine preferred foods with the view to identifying appropriate foods for supplementation and to determine which meals were the most beneficial in their contribution to the overall nutrient intake. Food consumption data were collected on consecutive days; between three and five 24h recalls were used in conjunction with the completed menu card retained by the patient. Recorded data included the proportion of the meal eaten, the reasons for choosing food items and whether the meal had been enjoyed. Food selection patterns in hospital patients were compared with those of a group of twenty-nine elderly women (mean age 78.4 years) attending a local day centre.

The main food preferences identified in the hospital patients were soups, puddings and mashed potatoes. In both groups their main meal was lunch. The day centre group ate more snacks between meals due to their availability. The main factors influencing food choice in the hospital patients were the expected taste and the familiarity of the food. After a few days in hospital the need for 'variety' and 'having a change' became a more frequent reason for choice. 'Healthiness' was a more common influence on food choice among the day centre visitors followed by 'routine' and 'familiarity'.

Analysis of the nutritional intake gained from the meals of the hospital patients found that breakfast contributed the most to the percentage intakes of vitamin C (40%), Fe (38%) and thiamin (38%). Lunch provided the largest contribution to energy (37%) and protein (53%), confirming its importance as the main meal of the day. However, the mean intakes of the hospital patients failed to meet 50% of the estimated average requirement for energy. Significantly lower intakes of energy (3.9 vs 5.8 MJ $p<0.001$) and most nutrients including protein (38.5 vs 58.3g $p<0.001$), Fe (5.6 vs 8.6mg $p<0.01$), Se (28.4 vs 40.6 μg $p<0.01$) and Ca (507 vs 692mg $p<0.01$) were found in hospital patients. Patients rarely ate a full meal, an observation found in similar studies which have found that elderly hospital patients are unable to cope with large volumes of food (Olin *et al.* 1996). The findings of the present study indicate that the nutritional status of elderly hip-fracture patients could be improved by smaller meals, between-meal snacks, use of whole milk in drinks, porridge and cereals, and the fortification of popular food choices such as soups, puddings and mashed potatoes.

We are grateful to hospital patients and nursing staff, visitors and staff at Moorcroft and Westgate Daycentres.

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