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Abstracts of Original Communications

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

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Edentulous persons attitudes and perceived barriers to increasing fruit and vegetable consumption. By PAULA MOYNIHAN, RACHEL HIGGINSON and CLAIRE MOODY, *The Dental School, University of Newcastle, Framlington Place, Newcastle upon Tyne NE2 4BW*

The edentulous have been shown to consume a diet low in fruit and vegetables and NSP (Moynihan *et al.* 1994; Steele *et al.* 1998), which may be in part due to impaired masticatory ability. However, it has been shown that prosthetic rehabilitation fails to result in dietary change in the absence of dietary intervention (Moynihan *et al.* 1997). With a view to intervention, the aim of the present study was to investigate attitudes and beliefs towards increased consumption of fruits and vegetables and identify perceived barriers to increasing intake of these foods.

Thirty-four edentulous persons (nine males and twenty-five females) aged 83 (range 60-95) years were recruited from Age Concern Luncheon Clubs in the Newcastle area. Volunteers were interviewed at home using a dietary interview survey (DIS) (Moody & Moynihan, 1998) based on the theory of planned behaviour (Ajzen & Fishbein, 1980). The DIS included belief statements e.g. 'eating more fruit would be good value for money' which were scored on a 7-point scale from strongly disagree (-3) through neutral (0) to strongly agree (+3). Corresponding outcome evaluation statements e.g. 'how important to you is it that eating more fruit would be good value for money' were scored on a 7 point scale from 1 (extremely unimportant) to 7 (extremely important). Belief scores and corresponding outcome evaluation scores were multiplied to give belief evaluation scores (-21 - +21) which are good predictors of overall attitudes (the higher the score the stronger the attitude). All data were analysed using Minitab and expressed as median scores with 95% CI (calculated using Wilcoxon one-sample test) to indicate if scores were significantly different to the neutral mid-point.

Belief statement	Fruit			Vegetables		
	Median	95% CI	Median	95% CI	Median	95% CI
It would be good value for money to eat more	12.0	6.0, 13.0	12.0*	7.0	13.0	7.0, 13.0
It would be easy to prepare more	6.0	0.0, 10.0	6.5	-5.0	10.0	-5.0, 10.0
It would be easy to store more	-6.0	-7.0, 1.5	-6.0	-8.0	0.0	-8.0, 0.0
Eating more would be healthy	12.0*	6.0, 16.5	12.0*	6.0	-16.5	6.0, -16.5
My health would improve if I ate more	0.0	-4.0, 5.5	0.0	-2.0	8.0	-2.0, 8.0
I would reduce my risk of cancer if I ate more	0.0	-2.0, 0.0	0.0	-1.5	2.5	-1.5, 2.5
I would reduce my risk of heart disease if I ate more	0.0	0.0, 7.0	0.0	0.0	7.0	0.0, 7.0
I would reduce my risk of bowel complaints if I ate more	14.0*	5.5, 15.0	13.0*	5.0	14.0	5.0, 14.0
Eating more would cause pain on chewing	-15.0*	-17.5, -7.0	-18.0*	-18.0	-8.0	-18.0, -8.0
Eating more would be difficult to chew	-21.0*	-21.0, -7.0	-21.0*	-21.0	-13.0	-21.0, -13.0
It would be tasty to eat more	6.0	-0.5, 7.5	7.0	-1.0	8.0	-1.0, 8.0
It would be boring to eat more	-6.0	-7.0, 4.0	-7.0	-10.5	2.0	-10.5, 2.0
Eating more would be filling	0.0	-3.5, 4.5	-1.0	-1.5	6.0	-1.5, 6.0
Eating more would be fattening	-10.0*	-14.0, -6.0	-9.0*	-12.0	-3.5	-12.0, -3.5

* Median values were significantly different from neutral mid-point.

These data suggest that chewing problems are not perceived as a barrier to increasing fruit and vegetable consumption by the edentulous elderly. The positive scores also show that subjects perceived eating more fruit and vegetables to be healthy and good value for money and to reduce risk of bowel complaints.

Funded by The Rank Prize Funds.

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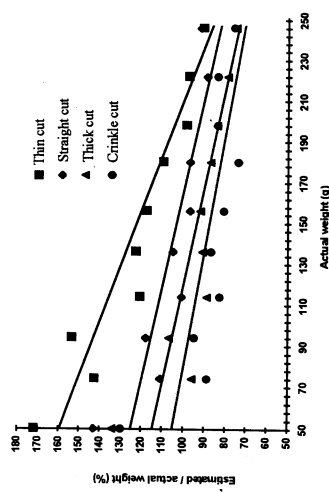
Perceptions of portion weights of different shapes of chips. By S. YOUNGSON and A. WISE. *The Robert Gordon University, Queen's Road, Aberdeen AB15 4PH*

It is important to consider the perceptions of people regarding the amounts of chips. Chips of different shapes and sizes take up more or less fat. Perceptions of portion size may also be important in surveys, when subjects are shown photographs of food portions. The chips that were used in the present study were straight cut, crinkle cut, thin cut (French fries) and thick cut (McCain). For each shape of chip, ten portion sizes were chosen with weights between 50 and 250 g, increasing in increments of between 20 and 26 g. The chips of each shape were fried in vegetable oil for 10-15 minutes until their golden colour appeared to be similar by eye. They were placed, with a fried fish in batter, on a dinner plate (diameter 250 mm) with a plain base and a patterned rim. The same dish, with the fish, was used for each shape and portion size of chip. The plates were visually coded with random numbers so as to give no clue to the actual portion weight. Colour photographs of the ten portion sizes were taken under standardised conditions with the camera mounted on a tripod and photographs printed at a size of 151 x 101 mm in landscape orientation, so that the chips were shown to about one quarter of their actual size. Eighty subjects aged over 16 years (forty male and forty female) were recruited from different groups in the community: students taking courses unrelated to nutrition, a pipe band, and a football club. Subjects were asked to spend about 5 min looking at twenty of the photographs (five of each shape of chips). Each portion weight of each chip shape was seen forty times. With the aid of a visual analogue scale (100 mm in length), subjects were asked to mark a vertical line to represent the portion size. They were told that the left of the line represented the lightest portion and the right of the line, the heaviest portion. The distance along the line was measured using a metal ruler and the estimated weight of chips determined by interpolation between 50 and 250 g. Results were calculated as the proportion of the actual weight that was estimated by the subjects and subjected to one-way ANOVA followed by Tukey's pairwise comparison tests; significance was assigned at a family error rate of 0.05.

It was found that people perceived that there were more of the thin-cut chips at all portion weights and this was significantly different to perceptions for all other chip shapes for weights less than 200 g. Perceptions of amount of chips did not differ significantly between the other shapes. The extent of the differences due to chip shape decreased with increasing portion weight.

Photographs are valuable aids in the estimation of food portion sizes and are easy to use in dietary surveys (Robinson *et al.* 1997). It is important, however, to consider the extent to which people can relate to the information presented to them in photographs. This study suggests that at most portion sizes, people perceive that there is a greater weight of chips present when given thin-cut chips. However, these chips have more fat per 100 g and hence people may obtain more fat even if they take less of this type of chip, believing that they have a greater portion than they actually have. Further research is needed to consider the way in which people perceive portion sizes of foods in general.

Robinson F, Morrit, W, McGuinness P & Hackett AF (1997) *Journal of Human Nutrition and Dietetics* 10, 117-124.



Relationships between dietary restraint, dietary iron intake and iron status in adolescent females. By C.B. MULVIHILL¹, P.J. ROGERS² and G.J. DAVIES¹, ¹Nutrition Research Centre, South Bank University, 103 Borough Road, London SE1 0AA and ²Department of Experimental Psychology, University of Bristol, Bristol BS8 1TN

Cultural pressure requiring a thin body shape, and the social stigma of obesity predominate in Western society and are experienced by adolescent girls. As a result, the restriction of food intake to maintain or reduce body weight is a commonly observed phenomenon in this age group. It has been suggested that dieting in adolescence is associated with lower Fe intakes (Crawley & Shergill-Bonner, 1995) and has also been found to have a negative effect on Fe status (Nelson *et al.*, 1993).

In the present study female adolescents (*n* 64) aged 14-15 years completed a 7 d weighed record of food intake. BMI was calculated for each subject and percentiles were determined using BMI charts (Cole *et al.*, 1995). Dietary restraint was assessed using the Dutch Eating Behaviour Questionnaire (DEBQ) (van Strein *et al.*, 1986) and the Three Factor Eating Questionnaire (TFEQ) (Stunkard & Messick, 1985). The sample was grouped into low, medium and high restraint groups according to a tertile split of the combined questionnaire scores. Fe status was determined by collection of a non-fasting venous blood sample, analysed for full blood count and serum ferritin. Ethical approval of the study protocol was obtained by East London and the City Health Authority Research Ethics Committee and Riverside Research Ethics Committee.

Level of dietary restraint...	Low			Medium			High		
	Mean (<i>n</i>)	SE	Mean (<i>n</i>)	SE	Mean (<i>n</i>)	SE	Mean (<i>n</i>)	SE	
BMI	19.6 (19) b	0.47	22.2 (20) a	0.56	23.9 (19) a **	1.18			
BMI percentile	43.1 (19) b	5.69	71.5 (20) a	4.94	74.8 (19) a **	5.48			
DEBQ restrained eating	1.51 (19) a	0.11	2.14 (20) b	0.15	3.19 (19) c **	0.16			
TFEQ restrained eating	1.84 (19) a	0.33	7.35 (20) b	0.27	13.5 (19) c **	0.53			
Energy intake (MJ)	8.99 (17) a	0.48	7.98 (16) ab	0.22	7.35 (13) b *	0.39			
Iron intake (mg)	9.59 (17)	0.50	9.46 (16)	0.77	9.46 (13)	0.57			
Iron density (per MJ)	1.08 (17)	0.04	1.19 (16)	0.09	1.29 (13)	0.04			
Haemoglobin (g/l)	135 (17)	1.73	130 (19)	2.11	135 (19)	2.01			
Serum ferritin (µg/l)	20.1 (17)	3.19	20.4 (19)	3.20	24.9 (19)	3.34			

Significantly different * *P* < 0.05, ** *P* < 0.001. Mean values not sharing the same superscript letter are significantly different. The Table shows that there were significant differences in body weight with BMI percentile values increasing in line with dietary restraint. Energy intake was found to be inversely related to dietary restraint. However a corresponding relationship between dietary restraint and reduced Fe intake was not found. In addition, there were no significant differences in mean haemoglobin and serum ferritin values between dietary restraint groups. Dietary sources of Fe were similar between dietary restraint groups, except that the proportion of Fe derived from bread and rolls increased with restraint compared with meat and meat products, which decreased.

The findings indicate that in the present sample dietary restraint was exercised by heavier subjects with a resulting lower energy intake, although this might be, at least in part, explained by under-reporting. Contrary to some previous findings, restraint did not compromise dietary Fe intake or status. This is consistent with the view that the DEBQ and TFEQ measure 'successful restraint' characterized by relatively healthy eating patterns and food choices (Mela & Rogers, 1998). However, overall intakes of dietary Fe in this sample were low, and 8 % of the sample were diagnosed with Fe-deficiency anaemia (Haemoglobin < 120g/l) with a further 12 % found to have depleted Fe stores (serum ferritin < 10 µg/l). It has been suggested that both poor Fe status and dietary restraint are associated with impaired cognitive performance. Therefore further work is needed to examine these possible effects in adolescent females.

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Effect of graded levels of exercise on body weight, appetite and food intake in normal-weight men consuming their normal diet in their natural environment. By R. J. STUBBS¹, A. SEPP¹, M. FLEMING¹, A.M. JOHNSTONE¹, D. A. HUGHES¹, C. A. REID¹, N. KING² and J. BLUNDELL², ¹Rowett Research Institute, Greenburn Road, Bucksburn, Aberdeen AB21 9SB and ²Biopsychology Group, Department of Psychology, Leeds University, Leeds, LS2 9JT.

Short-term, laboratory-based studies suggest that increases in energy expenditure (EE) through physical activity (PA) do not induce rapid or efficient compensatory increases in energy intake (EI). The purpose of the present study was to assess, under more ecological conditions and time-frame, the effect of graded increases in EE through PA on appetite, EI, approximate estimates of EE and body weight in men living in their normal environment.

Six men, (mean age 31.0 (SD 0.8) years; weight 75.1 (SD 2.4) kg; height 1.78 (SD 0.01) m; BMI 23.3 (SD 0.4) kg/m²), were each studied three times during a 9 d protocol, corresponding to No exercise (control) (NEX; 0 MJ/d), medium exercise level (MEX; 2x40 min sessions, (about 1.5 MJ/d) and high exercise level (HEX; 3x40 min sessions, (about 3.0 MJ/d). On days 1-2 subjects were given a medium fat (MF) maintenance diet, (1.6 x resting metabolic rate (RMR)). On days 3-9, they self-recorded dietary intake using a food diary and PETRA (Portable Electronic Tape Recorded Automatic) weighing system which has recently been validated in this laboratory (Johnstone *et al.* 1998). Each subject completed a pre- and post-treatment sub-maximal fitness test on a bicycle ergometer to (i) monitor fitness levels, and (ii) calibrate heart rate using the POLAR heart rate (HR) monitor against O₂ consumption, measured using the VMAX metabolic cart (Sensor Medics, USA). Subjects attended the Human Nutrition Unit to exercise daily to a required HR. EE was assessed using the modified FLEX method (Ceessay *et al.*, 1989). Body weight was recorded each morning before eating and after voiding. Subjects could entirely determine their own meal time, frequency and composition. They completed hourly hunger ratings during waking hours to record subjective sensations of hunger and appetite. ANOVA was conducted on EI, EE, body weight and hunger, using treatment and day as factors and subject and run as blocking factors. Mean daily EI, EE and total weight change are given in the Table.

	NEX	MEX	HEX	<i>P</i> value	SED
Energy intake (MJ)	11.54	11.77	11.78	<i>F</i> (2,10) 0.10	NS
Energy expenditure (MJ)	11.72	12.86	16.83	<i>F</i> (2,10) 48.26	<0.001
Body-weight change (kg)	-0.72	-0.58	-1.20	<i>F</i> (2,10) 0.89	NS

Markedly increasing EE through exercise did not produce any significant compensation and subjects consumed 1.58, 1.60 and 1.61 X BMR on the NEX, MEX and HEX treatments respectively. There was no treatment effect on hunger appetite or body weight, but subjects lost weight on each treatment. These data confirm previous short-term studies in suggesting that EI does not track changes in EE in men, over the medium term, with *ad libitum* access to their normal diet. This suggests that changing EE through PA is an effective strategy to alter medium-term energy balance in men able to attain high levels of EE. This work was part of a joint collaboration between the Rowett and Leeds, funded by BBSRC grant F0205.

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Effect of healthy-eating advice and consumption of reduced-fat 'ready meals' on nutrient intake in healthy, free-living volunteers. By JANE CARDEW^{1,2}, JOHANNA HIGNETT² and CHRISTOPHER SEAL¹, ¹Human Nutrition Research Centre, Department of Biological and Nutritional Sciences, University of Newcastle, Newcastle upon Tyne NE1 7RU and ²Nestlé UK Ltd, St George's House, Croydon CR9 1NR

Current healthy-eating guidelines advocate consumption of diets with less than 35 % of dietary energy from fat. However, since publication of this recommendation in the Health of the Nation White Paper (Department of Health, 1992), progress towards the target has been slow, with the current population average being 39.7 % dietary energy from fat (Ministry of Agriculture Fisheries and Food, 1996). Further reductions in fat intake will require major changes in eating habits. One possible method is the increased consumption of ready prepared reduced- or low-fat meals as part of a balanced diet. The present study investigated the effect of incorporating such meals into the diets of free-living healthy volunteers given healthy-eating advice.

Sixteen volunteers (ten female, six male), aged between 18 and 65 years were recruited from the University of Newcastle (n 5), a Leisure Club (n 6) and a Community Resource Centre (n 5). Each completed a 7 d dietary record with estimates of food portion sizes as a measure of their baseline diet (D1). All volunteers were given healthy-eating advice based on analysis of their diet and using The Balance of Good Health model (Health Education Authority, 1994). Volunteers were also given advice on cooking methods (e.g. grilling foods rather than frying), a collection of ten 'healthy' recipe ideas and a Lean Cuisine Healthy Lifestyle Guide[®]. Half of the volunteers were provided with a selection of reduced-fat 'ready meals' and were asked to incorporate one meal each day as part of their diet. All volunteers then completed a second 7 d dietary record (D2) starting four days after receiving the dietary advice alone (A group) or the dietary advice plus reduced-fat meals (AM group). Dietary analysis was carried out using the Comp-eat dietary analysis package (Nutrition Systems, London). The effect of intervention within each group was assessed by paired *t* test and the difference between groups was assessed by two-sample *t* test.

Daily nutrient intake	Group A			Group AM			D1-D2		
	D1	D2	P	D1	D2	P	A	AM	P
Total energy (MJ)	6.67	6.93	0.26	7.78	6.88	0.09	0.26	-0.90	0.13
Total fat (g)	59.9	53.6	0.18	70.1	50.8	0.00	-6.3	-19.3	0.13
Total fat (% energy)	33.7	29.0	0.03	32.0	25.3	0.01	-4.6	-6.7	0.49
SFA (g)	18.3	17.1	0.31	24.7	15.8	0.01	-1.3	-8.9	0.07
SFA (% energy)	10.3	9.1	0.14	10.9	7.7	0.03	-1.1	-3.2	0.25

SFA, Saturated fatty acids

At baseline (D1) both groups were consuming diets which met current guidelines for fat intake. However, during D2 total fat and saturated fat intakes fell in both groups and this effect appeared to be greater in the AM group although between-group comparisons were not statistically significant. The results suggest that in well-motivated volunteers receiving tailored healthy-eating advice, incorporating reduced-fat meals in the diet may be of benefit in further reducing fat intake. Further studies on the long-term effects of consuming reduced-fat meals in the general population are planned.

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 Ministry of Agriculture, Fisheries and Food (1996) *National Food Survey 1996. Annual Report on Food Expenditure, Consumption and Nutrient Intakes*. London: H. M. Stationery Office.

A comparison between the National Food Survey (NFS) and the Family Expenditure Survey (FES) data. By SOPHIA E. PATERAKIS and MICHAEL NELSON, Department of Nutrition and Dietetics, King's College London, Campden Hill Road, London W8 7AH

Proposals are afoot to combine the National Food Survey (NFS) (Ministry of Agriculture, Fisheries and Food, 1997) with the Family Expenditure Survey (FES) (Office of National Statistics, 1996). The two surveys include nationally representative samples of the population which are similar in composition, and both obtain detailed information on food expenditure. The NFS also includes information on quantities of food acquisitions, menu patterns and, since 1992, records of food consumed away from home. Furthermore, it has the advantage of specifying more food codes (220 in the NFS v. sixty in the FES), which allows for a detailed nutritional analysis of the data. It is important that these aspects of the NFS be preserved in any amalgamation.

A crucial step before amalgamation is to assess the level of agreement between the two surveys when examining trends in food expenditure patterns and differences between subgroups (e.g. income groups, regions). If the two surveys do not show similar trends and differences between groups over time, it suggests that biases in the data differ between surveys.

The present analysis examines time trends in food expenditure in the NFS and the FES between 1982 and 1993. Data in the two surveys were aggregated to create comparable food groups. Sweets, soft drinks, alcoholic beverages and foods purchased and eaten away from home were excluded. Differences in expenditure between surveys according to household composition, income groups and regions, and by survey over time were also assessed. Expenditure on food was adjusted for inflation using the retail price index, in order to facilitate comparisons over time.

Log % difference (100 log_e(NFS) - 100 log_e(FES)) (TJ Cole, personal communication) varied, from 1982 to 1987, between -1 % and +5 %, falling gradually to -7 % in 1993. When differences were analysed by food group, NFS estimates were usually higher than FES in every year analysed with the exception of cereals and miscellaneous, and sugar products and beverages since 1992. The miscellaneous food group showed the highest mean difference between the two surveys (-36 %). Log % differences of total food expenditure (analysed by year) were more varied when analysed according to household composition (range: -19 % to +18 %), income group (range: -18 % to +4 %) and region (range: -18 % to +19 %).

There is no obvious reason for the shifting trend in differences in total food expenditure between the two surveys. Methodological differences do not explain the shifting trend. (In the NFS the diary keeper focuses for 1 week on household food acquisitions alone, while in the FES all household members focus for 2 weeks on all expenditure.) The FES food groups are not as closely defined as those in the NFS and some foods in the FES are classified as 'undefined'; these then appear in our 'miscellaneous' category. This may partly explain why FES expenditure for 'miscellaneous foods' is consistently higher.

It would be unwise to combine the two surveys until a better understanding of the reasons for differences in results can be established. Moreover, it is important to preserve the food quantity data currently obtained in the NFS but not the FES in order to retain the potential for detailed nutritional analyses.

The findings in this report are based on material derived from the Family Expenditure Survey and the National Food Survey. Material from these two surveys is Crown copyright. It has been made available by the Office for National Statistics (ONS) through the Data Archive, based in the University of Essex. Neither the ONS nor Data Archive bear any responsibility for the analysis or interpretation of the data reported here.

Ministry of Agriculture, Fisheries and Food (1997) *National Food Survey, 1996*. London: The Stationery Office.
 Office of National Statistics (1996) *Family Spending: A Report on the 1995-96 Family Expenditure Survey*. London: The Stationery Office.

Socioeconomic differences in the dietary trends in Karachi. By RUBINA HAKEEM and MUSARRAT ZIAEE, *Department of Food and Nutrition, Rana Liaqat Ali Khan Government College of Home Economics, Stadium Road, Karachi-74800, Pakistan*

The present study was conducted to explore socioeconomic differences in the perceptions of Pakistani housewives regarding the dietary trends in their families, and factors responsible for the reported trends. A total of 180 housewives (sixty each from low, middle and high-income groups) were requested to identify food items from a list of thirty two, and state whether the consumption was increased, decreased or the same in comparison with 20 years ago; and if it was changed what was the reason.

According to the mean number of food items for which change in consumption was reported the change did not appear to be extensive but socioeconomic difference in this regard was noticeable.

Dietary trend	Socioeconomic status		
	High	Low	Middle
Unchanged	24.13	26.56	22.73**
Decreased	3.50	3.90	3.27
Increased	4.38	1.54	5.95***

** $P=0.002$ ANOVA: Mean values were significantly different from low-to-middle ($P=0.000$), and low-to-high ($P=0.023$) income level
 *** $P<0.0001$ ANOVA: Mean values were significantly different from low-to-middle ($P=0.000$), low-to-high ($P=0.000$), and middle-to-high ($P=0.044$), income level

Qualitative differences were also noted in the three groups in terms of change in food consumption. For example the consumption of ghee (hydrogenated vegetable oil), beef, sweets, chocolates, and butter was more often decreased and that of low-energy drinks, ordinary fizzy drinks, chapati, milk without cream and fruit juices was more often increased in high-income families. On the other hand in low-income families the consumption of chapati, fresh fruits, ordinary white bread and fruit juices was more often decreased and that of ordinary fizzy drinks, chicken, chips, sweet dishes and lentils was more often increased. In most cases the middle-income families were similar to the high-income families in terms of dietary trends.

Socioeconomic differences were noted also in the reasons for the dietary change. The first five most often mentioned factors considered to be responsible for the dietary change by low-income families were: cost, likes, time available for food preparation, dislikes and season; health, likes, availability, cost, and time were mentioned by the middle-income families; and health, likes, availability, time and dislikes were mentioned by the high-income families.

It is concluded that in urban Pakistani families at the higher income levels dietary trends appear to move towards a healthier diet, which is termed as a pattern of behavioral change by Popkin (1994); whereas in low-income families factors such as lack of financial resources and lack of awareness are checking this positive trend.

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Popkin B M (1994) *Nutrition Reviews* **52**, 285-298.

Food availability at a local level: do the poor have worse choice? By ANGELA J.M. DONKIN¹, ELIZABETH A. DOWLER¹, SIMON J. STEVENSON² and SHEILA A. TURNER³, *¹Public Health Nutrition Unit and ²Environmental Epidemiology Unit, London School of Hygiene and Tropical Medicine, Keppel St., London WC1E 7HT, ³Institute of Education, 20 Bedford Way, WC1H 0AL*

The present paper reports quantitative data collected as part of a study to develop and map indices of access to healthy food in a deprived area using systematic quantitative and qualitative survey instruments. Two contiguous wards in London were selected with high positive Carstairs deprivation scores (Carstairs & Morris, 1989). A 2km area was defined around a randomly chosen central point. This area encompassed 227 enumeration districts (ED) (approximately 140 households in each) with a mean Carstairs score of 2.62 (SE 0.16), indicating an area of relative deprivation. All retail outlets selling food within the area were visited and their location recorded. These were mapped using Geographical Information System (GIS) software, along with Carstairs scores by ED. Data on availability of 123 food items were collected from a total of 210 shops between December 1997 and April 1998. Seventy-one items had been chosen to reflect a mix of foods acceptable to the local ethnically diverse population and which, in combination, would contribute to a healthy diet (Department of Health, 1991); the price of these items was also collected. The remaining items included foods which would not necessarily contribute to a healthy diet (e.g. sweets, chocolates, sausages), or which would contribute store cupboard ingredients (e.g. sugar, tea) or could be used as an indication of the availability of specially formulated 'health' foods (e.g. vegetable-oil-based ghee, reduced-fat cheddar).

For ninety-four foods there was no association between a shop stocking them and the ED Carstairs score. For twenty-three foods, there was a positive association between the shop stocking them and a high Carstairs score. The foods more likely to be found in shops in ED of greater deprivation were fruits ($n=5$), vegetables ($n=14$) and foods traditional to an Asian diet ($n=4$). The number of fresh fruits ($r=0.1622$, $P=0.024$) and fresh vegetables ($r=0.1810$, $P=0.001$) available within shops was also higher in ED of greater deprivation. Wholemeal bread, low-energy and 'normal' carbonated drinks, granulated sweeteners, sweets and chocolates, and orange juice were found to be significantly more available in ED of lower deprivation. There were fifteen different types of outlets selling food. Of these, the Table shows that post offices, and garage forecourts were the most likely to be located in ED of relative affluence within the area, while bulk purchase outlets, greengrocers and fishmongers were more likely to be in ED of relative deprivation. The data within this area suggest that lack of physical access to fruit, vegetables and fish may not be a major constraint upon choice.

Type of shop	Mean Carstairs score	SE
Post offices ($n=4$)	0.11	0.41
Garage forecourts ($n=9$)	1.17	0.55
Supermarkets ($n=24$)	2.65	0.38
Green grocers ($n=28$)	3.46	0.33
Bulk purchase outlets ($n=6$)	3.58	0.40
Fish mongers ($n=3$)	4.34	0.91

Carstairs V & Morris R (1989) *British Medical Journal* **299**, 886-889.
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Social class differences in foods eaten by a national sample of 4-year-old children in 1950. By C.J. PRYNE¹, A.A. PAUL¹, G.M. PRICE¹ and M.E.J. WADSWORTH², ¹MRC Human Nutrition Research, Milton Road, Cambridge CB4 1XJ and ²MRC National Survey of Health and Development, University College and Royal Free Medical School, 1-19 Torrington Place, London, WC1 0BT

Food rationing during World War 2 and the immediate post-war period reduced the substantial inequalities in food and nutrient intake between social classes (SC) which existed before the war, but did not eliminate them (Ministry of Food, 1952). The diet of those who were children at that time is of great interest as they are now reaching the age at which degenerative diseases become apparent. One-day records of meals eaten by 4599 4-year-old children were collected in 1950 as part of the on-going MRC National Survey of Health and Development (Wadsworth, 1991). These have only now been coded and analysed for food and nutrient intake, using the Dunn Nutrition Unit's programs (Price *et al.* 1995). The children were grouped according to their father's SC and the percentages of children eating particular foods or groups of foods were compared. Bread and milk were almost universally consumed and the frequencies of consumption showed no differences between SC; nor were there any differences in the consumption frequencies of potatoes, eggs or red meat which were eaten by 71, 55 and 70 % of the children respectively. However some items of the diet showed a very clear gradation from SC I to SC V.

	Non-manual (% consumers)				Manual (% consumers)				Significance of Chi-square
	SC I (n 259)	SC II (n 278)	SC III (n 807)	SC IV (n 934)	SC I/II (n 1400)	SC III/IV (n 291)	SC V (n 16)	SC I/II vs SC III/IV vs SC V	
Total n 4419*	8	7	10	14	14	14	16		P < 0.001
Chips	82	77	77	72	72	71	67		P < 0.001
Vegetables†	12	8	8	6	6	4	2		P < 0.001
Carrots	59	55	54	40	40	37	29		P < 0.001
Fruit	76	77	72	69	69	66	62		P < 0.001
Cakes, biscuits, puddings	22	10	17	7	7	7	9		P < 0.001
Orange juice‡	27	45	51	60	60	62	66		P < 0.001
Tea§	33	34	32	26	26	24	21		P < 0.001
Bacon§									P < 0.001

* Not including unclassified, (armed forces).
 † Chi-square Mantel-Haenszel test for linear association.
 ‡ Green vegetables, peas, beans, tomatoes.
 § Food rationed.

Although fruit and vegetables, including potatoes, were not rationed after May 1950 this did not mean that they were universally available. Orange juice was distributed through the Welfare Foods Distribution Centres and it would appear that the take-up was much better among the non-manual classes. Children did not have a tea ration but, particularly in classes IIIM, IV and V, they frequently shared the family pot. Cooking fats were rationed so it is not surprising that the overall number of children eating chips was small. However, proportionately twice as many children from SC V ate chips compared with SC I. Conversely, vegetables, carrots in particular, and fruit were more often consumed by the children of the non-manual classes. These differences may have been due to economic circumstances and accessibility of supplies or may represent the response of the non-manual classes to Government nutritional information. The rationing of red meat did result in an equitable distribution but there was a downwards trend from non-manual to manual classes in the consumption frequency of bacon which was relatively more expensive.

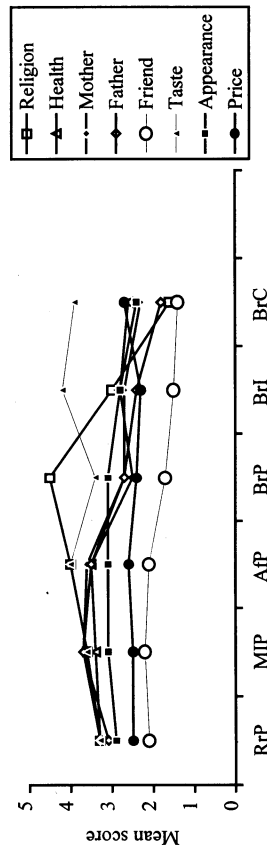
These differences in the consumption frequencies of particular foods between the SC in 1950 would have had profound implications for the intake of micronutrients by these children. Their long-term health prospects may be affected either at the biochemical level or by the continuation of childhood food habits into adult life. As these children have been monitored to the present day it will be possible to relate this data to their current health status.

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 Price G M, Paul A A, Key F B, Harter A C, Cole T J, Day K C & Wadsworth M E J (1995) *Journal of Human Nutrition and Dietetics*, **8**, 417-428.
 Wadsworth M E J (1991) *The Imprint of Time*. Oxford: Clarendon Press.

Socio-cultural determinants of children's food choice. By RUBINA HAKEEM¹, JANE THOMAS² and SALMA H. BADRUDDIN³, ¹Department of Food and Nutrition, RLAK Government College of Home Economics Stadium Road Karachi-74800, Pakistan; ²Department of Nutrition and Dietetics, King's College London W8 7AH; ³Department of Medicine/Community Health Sciences, The Aga Khan University, Stadium Road, Karachi-74800, Pakistan

Both culture and individual experience contribute to the variation in human food selection (Rozin, 1980). In order to understand the interplay of culture and social factors in determining children's food selection, 623 10-12-year-old schoolchildren belonging to six different groups were asked to identify the perceived importance of various factors influencing their food choice. Three groups represented different levels of affluence and urbanization within the same cultural milieu. These groups included rural Pakistani (RrP, n 100), middle-income urban Pakistani (MIP, n 148) and affluent urban Pakistani (AUF, n 159) residing in the province of Punjab in Pakistan. Three further groups of children were drawn from the same geographical area (Slough) in the UK, but with different cultural backgrounds: British Pakistani (BrP, n 110), British Indian-Sikh (BrI, n 72), and British Caucasian (BrC, n 34). Schools were selected on the basis of the catchment population. All 10-12-year-old children from the selected school, who were willing to participate were included in the study. The students completed a questionnaire in school.

Children were asked to indicate on a five-point ranking scale the degree to which certain factors influenced their food choice (higher score meant more importance was given to that factor). Comparison of the means of the ranks for each factor according to group indicated that urbanization, (RrP v. MIP), affluence (MIP v. AUF) migration, (AUF v. BrP) culture (BrP v. BrC) and religion (BrP v. BrC and BrI) played an important role in shaping the children's food choices (Fig.).



Although urbanization and affluence within Pakistan made a slight difference to the relative importance of the selected factors, its impact was not as great as that of migration. While the multicultural environment accentuated the importance of religion for BrP it decreased the perceived influence of parents on food choice; it also made taste less important for them than it was for BrI and BrC children. It is concluded that both cultural background and environment play a role in shaping children's strategies for food choice.

Rozin P (1980) *International Journal of Obesity* **4**, 333-337.

Grazing trade-offs between forage intake and faecal avoidance in sheep: the effect of sward height, parasitic status and level of feeding motivation. By M.R. HUTCHINGS¹, I. KYRIAZAKIS¹, D.H. ANDERSON¹, I.J. GORDON² and F. JACKSON³. ¹Animal Biology Division, SAC, West Mains Road, Edinburgh EH9 3JG, ²Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen AB15 8QH, ³Moredu Research Institute, Pentlands Science Park, Penicuik EH26 0PZ

The deposition of dung on pasture may create a trade-off between the benefit of increased forage intake rate through grazing tall swards associated with faeces decomposition and the risk of parasitism due to migration of helminth parasite larvae from the faeces to the sward. Physiological state can affect herbivore foraging decisions in relation to faecally contaminated pasture. Our objectives were to determine whether such a trade-off exists for sheep and whether level of feeding motivation (FM) and parasitic status affect their grazing behaviour when faced with this trade-off. Texel x Greyface ewe lambs were presented pairs of swards (36 x 21 cm) which varied in height (H+ = 12 cm, H- = 6 cm) and level of contamination with faeces from sheep infected with *Ostertagia circumcincta* (Ost.) (20 g faeces per sward = F+; no faeces = F-) and allowed to graze for short periods (sixty bites or 10 min). Expt 1 presented four choices (1) H+F+ v. H-F- (2) H+F+ v. H-F- (3) H+F- v. H-F- and (4) H+F- v. H-F- repeated three times to twenty four lambs (6 months old; 36.4 (SE 4.20) kg live weight) divided into four animal treatment groups resulting from two levels of FM (FM- = three weeks 'to appetite' FM+ = three weeks fed 60 % of 'to appetite' ration) and two parasitic states (P+ = trickle dose of Ost., P- = non-parasitized). Expt 2 presented the same four choices three times each to twenty four lambs (12 months old; 60.8 (SE 1.04) kg live weight) in four animal treatment groups created from two parasitic states (P+, P-) and two immune states (I+ = immune to Ost., I- = naive). Bite number taken from each tray was recorded for each choice along with the grazed height above the soil surface.

When presented the H+F- v. H-F- choice (3) the tall sward was selected over the short sward by all animal treatments in both experiments (P<0.01). When presented the trade-off (choice 1), FM+ animals took greater parasitic risks than FM- animals in Expt 1 (P<0.05). Sub-clinical parasitism resulted in increased rejection of the H+F+ sward (P<0.05) and reduced grazing depths (P<0.05) compared with non-parasitized animals thereby reducing further risk of parasitism in Expt 1. This effect of parasitism was not repeated in the older animals of Expt 2, where all animals regardless of parasitic status maintained a high parasite risk grazing strategy by selecting the H+F+ sward of the trade-off choice (P<0.05). However, P+ animals in Expt 2 minimized parasite intake and, therefore, the risks associated with grazing the H+F+ sward by significantly reducing their grazing depth (P<0.05) compared with all other treatment groups. I+ treatments selected the H+F+ sward of choice 1 to a greater extent than I- treatments in Expt 2 (P<0.05). In each of the remaining three choices in both Expts one sward held a height or faecal benefit (absence of faeces) which was selected for by all treatments (P<0.05).

Effect of FM and P status (Expt 1) and I and P status (Expt 2) on the diet selected by sheep. Values are arcsine back-transformed mean proportion of bites taken from sward 1 in each choice.

Choice	Expt 1: Feeding motivation				Expt 2: Immune status				
	To appetite		60 % to appetite		Naive		Immune		
	P+	P-	P+	P-	P+	P-	P+	P-	
Sward 1 v. sward 2	0.31*	0.56	0.73*	0.62	0.120	0.83*	0.90*	0.98*	0.99*
(1) H+F+ v. H-F-	0.80*	0.68*	0.82*	0.69*	0.156	0.97*	0.99*	1.00*	1.00*
(2) H+F+ v. H-F+	0.94*	0.91*	0.99*	0.98*	0.144	0.96*	0.93*	0.95*	0.98*
(3) H+F- v. H-F-	1.00*	0.98*	1.00*	0.99*	0.069	0.99*	0.99*	1.00*	1.00*

Significantly different from random 0.5; *P<0.05.

Sheep are able to make complex grazing decisions involving sward height and faecal avoidance and these decisions are affected by their physiological state and age. Young lambs are more faecal averse than older lambs when faced with trade-offs between the benefit of forage intake rate through grazing tall swards and the cost of ingestion of parasites. The nutritional advantage associated with grazing tall swards can overcome faecal aversion in herbivores.

Species composition of sheep diets when grazing grass/clover swards: the effect of parasitic status and level of feeding motivation. By M.R. HUTCHINGS¹, I.J. GORDON², E. ROBERTSON², I. KYRIAZAKIS¹ and F. JACKSON³. ¹Animal Biology Division, SAC, West Mains Road, Edinburgh EH9 3JG, ²Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen AB15 8QH, ³Moredu Research Institute, Pentlands Science Park, Penicuik EH26 0PZ

To counter increased endogenous loss of protein and increased damage to gut tissue, sheep with gastrointestinal parasites increase the level of protein selected in their diet when offered pelleted foods. Grazing herbivores can select a diet whose composition can be nutritionally richer than that of the average available herbage. However, whether grazing herbivores use such foraging skills to counter the effects of parasitism through diet selection is unknown. Our objective was to determine the effects of parasitic status and level of feeding motivation on the diet selected by sheep grazing grass/clover swards. Twenty four Scottish Blackface lambs (5 months old; 32.1 (SE 0.63) kg live weight) were divided into four animal treatment groups. Pre-grazing treatments were imposed for three weeks to create two levels of feeding motivation, low (fed *ad libitum*) and high (60 % of *ad libitum* ration) and two parasitic states, parasitized (P+) (daily dose of 2500 L₃ *Ostertagia circumcincta*) and non-parasitized (P-). At the start of the experiment (day 0) each group was placed in one of four 0.35 ha field plots and allowed to graze an established grass/clover sward for 14 d. The N content of the clover (31 g/kg DM) was higher than that of the grass (14 g/kg DM). Animal treatment groups were rotated around the four plots on a daily basis. Species compositions of the swards and sward structure in each experimental plot were quantified using twenty grass samples taken to ground level (sampling area 10 x 2 cm) from each plot on days 0, 7 and 14 of the experiment. The diet selection and intake of the animals were determined using the n-alkane method. Activity time and grazing behaviour were measured using direct observations and vibracorders. Within-bout interval and between-bout interval were distinguished using the concept of satiety. Faecal egg counts (FEC) were taken weekly from day 21 to day 14 of the experiment.

The initial level of clover in the sward (62.2 kg DM/ha = 1.87 % of the sward) was reduced by two-thirds by day 7 and completely removed by day 14 of the experiment. Lambs with a high level of feeding motivation actively selected clover whilst grazing (P<0.001) and had a significantly higher proportion of clover in their diet compared with animals with a low level of feeding motivation (see Table). Parasitic status had no effect on the diet selection of sheep; however, using FEC from day 7 of the experiment, an increase in parasitic burden (determined by FEC) in parasitized animals was correlated with an increase in the proportion of clover in the diet (P<0.05). Parasitized animals spent less time grazing each day resulting in reduced forage intakes compared with non-parasitized animals (see Table). Lambs with a high level of feeding motivation had a greater number of feeding bouts per day resulting in greater forage intakes than animals with a low level of feeding motivation.

Treatment effects	Feeding motivation				Treatment effects			
	Ad lib		60% ad lib		P	FM	P x FM	NS
	P-	P+	P-	P+				
Proportion clover in diet	0.048	0.134*	0.407*	0.428*	0.0782	NS	***	NS
Forage intake (kg DM/d)	1.430	0.993	1.926	1.363	0.1720	**	***	NS
Total grazing time (min/d)	644	585	614	595	16.7	*	n.s.	NS
Number bouts (d)	5.98	5.44	6.44	6.47	0.276	NS	**	NS

P, parasitic status; FM, feeding motivation. Mean value was significantly different from that in the sward, day 7 (= 0.00663); *P<0.05.

Level of feeding motivation had a greater effect on the diet selection of lambs than parasitic status. Highly-feeding-motivated lambs heavily selected clover in their diet selecting up to sixty five times the proportion of clover in their diet compared with that in the sward. Physiological state in sheep is capable of dramatically affecting species composition of a sward.

Food expenditure and child growth in deprived families living in London. By MICHAEL NELSON, CRISTINA EASTWOOD, and CAIREEN ROBERTS. *Department of Nutrition and Dietetics, King's College London, Campden Hill Road, London W8 7AH*

Twenty-two years ago, Nelson & Naismith (1979) carried out a study to assess growth and health in children living in deprived circumstances in London. The recent report on inequalities in health (Acheson, 1998) and the commitment by the Social Exclusion Unit (1998) to reduce social inequalities prompted us to reassess the relationship between child growth and health and socioeconomic characteristics of London children. Eighty-two children from fifty-one 'at risk' families were selected from a cross-section of patients attending a surgery adjacent to a tower block estate in South London. 'At risk' was defined as being on Income Support, being a lone mother, having four or more children, and/or living in overcrowded conditions (>1.5 persons per room). Many families fell into more than one 'at risk' category. Children between the ages of 1 and 12 years were measured for height and weight. Their parents were asked about the amount of money spent for the family each week on food, and about each child's health.

The Table shows the mean age, reported expenditure on food per person per week, height centile, weight centile, birth weight, and percentage of children with recurrent diarrhoea according to whether family spending on food was above or below the median expenditure per person per week (£15.80).

	Below median expenditure (n=41)		Above median expenditure (n=41)		P value	
	Mean	SE	Mean	SE	Unadjusted	Adjusted
Age (years)	5.05	0.52	5.74	0.50	0.340	-
Food/person/week (£)	10.78	0.41	20.47	0.77	0.000*	0.000*
Birth weight (g)	3106	77	3383	91	0.022	0.025†
Height (centile)	42.4	4.7	59.1	4.8	0.015	0.025†
Weight (centile)	58.3	5.1	71.0	4.2	0.058	0.014‡
Children with recurrent diarrhoea (%)	49	-	16	-	0.002	($\chi^2=9.52$)

*Adjusted for maternal height, birth weight, height centile and ethnic group

†Adjusted for maternal height and ethnic group

‡Adjusted for maternal height, birth weight and ethnic group

Children living in families spending less than the median amount on food (£15.80 per person per week in a 'good' week, less in a 'bad' week when competing expenditures reduced the amount available to spend on food) were of similar ages to those spending more than the median, but had significantly reduced birth weight, height and weight (when adjusted appropriately for age, maternal height, birth weight, and ethnic group), and a higher percentage of children with persistent diarrhoea. In regression analyses, the amount spent on food was the single strongest predictor of height.

These findings confirm that money spent on food is of primary importance in relation to child growth, even when other factors such as birth weight and parental height are taken into account. The association of recurrent diarrhoea with expenditure on food suggests that spending on food may be a marker for poor sanitary conditions in these families.

Acheson ED. (1998) *Independent Inquiry into Inequalities in Health*. London: The Stationery Office.

(<http://www.doh.gov.uk/ih/ih.htm>)

Nelson M & Naismith DJ. (1979) The nutritional status of poor children living in London. *Journal of Human Nutrition* 33, 33-45.

Social Exclusion Unit. (1998) *Bringing Britain Together: A National Strategy for Neighbourhood Renewal*. (<http://www.open.gov.uk/co/seu/bbt.pdf>)

The effect of nitrogen form on the diet selection of sheep which have been deprived of protein in different ways. By GEORGIOS ARSENOS and ILIAS KYRIAZAKIS, *Animal Biology Division, Scottish Agricultural College, West Mains Road, Edinburgh EH9 3JG*

It has been suggested that animal state plays an important role in the recognition of the nutritional properties of a food (unlearned specific appetite) and subsequent diet choice. Although detailed work has been done on diet selection in ruminants, to date there is a lack of information regarding this hypothesis. In the present study two specific objectives were tested: (i) whether current animal state influences its immediate ability to recognize foods containing different N sources, and (ii) whether food N source affects this response of a ruminant and its ability to select a diet that best meets its needs. Seventy-two Texel x Greyface female lambs, weighing 28.3 (SD 3.32) kg, were used and equally divided into three groups (H, L1 and L2). Three foods, two basal (high in protein, HP and low in protein, LP) and one test (T) were used. Foods HP and LP were formulated as pellets (160 and 69 g/kg DM crude protein (CP) respectively and 10.4 MJ/kg DM metabolizable energy (ME) both), while T was formulated as a meal (68 g/kg DM CP and 10.4 MJ/kg DM ME). Food HP was offered to group H and food LP to groups L1 and L2 *ad libitum*, for an initial period which lasted 23 d for groups H and L1 and 51 d for group L2. Thus, comparisons between groups could be made at either equal time (H and L1) or equal live weight (H and L2). Subsequently, sheep were given a choice between food T and foods which were prepared by mixing T with an N-supplement. The supplements were urea (food U), sodium caseinate (food C) and formaldehyde-treated caseinate (food FC) which were added at 20.5 g U, 64.0 g Na-caseinate and 64.0 g HCHO-caseinate per kg T respectively, so that foods U, C and FC were isonitrogenous. The main experiment for all groups of sheep consisted of three periods lasting 7 d each. During periods I and III sheep were offered the following choices: T v. U, T v. C and T v. FC (n 24 per choice) while in period II (defined as 'training') they were given access to single foods (U, C and FC for each choice treatment respectively). Diet selection was expressed as a proportion of food T selected by sheep on each choice treatment over total intake.

Effects of animal state and choice treatment on diet selection, expressed as proportion of T food (g T consumed/g total intake) selected during the two choice periods.

Choice	Period I						Period III					
	State		Mean	SE	State		Mean	SE	State		Mean	SE
	L1	L2			L1	L2			L1	L2		
T v. U	0.61*	0.59*	0.64*	0.021	0.55	0.50	0.59*	0.013	0.55	0.59*	0.55	0.013
T v. C	0.60*	0.60*	0.54	0.022	0.61*	0.40*	0.59*	0.022	0.53	0.66	0.66	0.023
T v. FC	0.87*	0.75*	0.90*	0.018	0.82*	0.48	0.67*	0.023	0.66	0.66	0.66	0.023

Significant different from random 0.5; *P<0.05.

There was a temporal increase in the selection of N-supplemented food in period I for all choice and animal state treatments; this was absent in period III. Diet selection differed significantly between animals of different states (P<0.05), with L2 animals selecting a higher proportion of the N-supplemented food than the other two groups (P<0.001). This was more evident in period III (P<0.01). Choice treatment also had an effect (P<0.001) on diet selection: animals on T v. FC chose selected overwhelmingly for T, with the exception of L2 animals in period III. Animals consumed readily the N-supplemented foods when they were offered singly in period II (1855, 1734 and 1733, SED 97.3 g for foods U, C and FC respectively). The results suggest that animals need a period of 'training' in order to be able to select for an N-supplemented food. There is not an 'unlearned specific appetite' for protein in sheep. Although animal state affects mean diet selection, the temporal development of diet selection is unaffected by it. Animals select more from foods supplemented with rumen degradable sources of N (U and C) rather than undegradable N (FC), on an isonitrogenous basis. This is unlikely to reflect selection for a certain level of metabolizable N, but rather the importance the animal gives to the maintenance of certain rumen environment conditions (e.g. NH₃-N production).

Low cost but acceptable food budget standards for households with young children. By MICHAEL NELSON, JULIE DALLISON and SOPHIA PATERAKIS, *Department of Nutrition and Dietetics, King's College London, Campden Hill Road, London W8 7AH*

Food budget standards are necessary to establish the level of expenditure required to attain a given standard of consumption and dietary adequacy. The budgets presented represent a 'low cost but acceptable' (LCA) level of expenditure for two household types, a couple with two young children (girl aged 4 years and boy aged 10 years) and a lone mother with two young children of the same sexes and ages. The LCA baskets:

- (1) represent a pattern of consumption that is characteristic of households of a given income level within the UK, and are based on National Food Survey and Family Expenditure Survey data;
- (2) contain a balance of foods which will promote short- and long-term health in both adults and children, based on Department of Health and Health Education Authority guidelines; and
- (3) are based on foods which are widely available at low prices using Sainsbury and KwikSave national price bases.

The budgets include menus which illustrate how the proposed baskets of foods could be used to feed the families.

The LCA food budgets differ from the previously reported modest but adequate food budgets (Nelson *et al* 1993) in two ways: they are based on food purchasing patterns (taken from the National Food Survey) for households at a lower income level; and they require foods to be purchased at lower prices. The main consequence of these differences is a more restricted diet, but one which is cheaper. Focus-group discussions were used to inform the choice of food items for purchase.

The Table shows the level of expenditure required to reach LCA level at January 1998 prices:

	Couple with two children	Lone mother with two children
Total food, home budget	£49.12	£32.66
Foods purchased and eaten away from home	£10.04	£4.81
Total budget, food only:		
(a) if no alcohol included in the diet.	£59.16	£37.47
(b) if alcohol included in the diet	£57.32	£36.78
Alcohol	£8.62	£4.01
Total budget, food plus alcohol	£65.94	£40.79

The level of food expenditure recommended in these budgets provides for a healthy and balanced diet, including 5 portions of fruit and vegetable per day. It is substantially above the levels reported in the bottom 20% of expenditure in the National Food Survey or Family Expenditure Survey. It represents amounts well above expenditure typical of families on Income Support. We conclude that families with children who are dependent upon Income Support or low wages are unlikely to be able to afford a healthy diet.

Nelson M, Mayer AB & Manley P (1993) In *Budget Standards for the United Kingdom*, [J. Bradshaw, editor]. Aldershot: Avebury.