Diet and health of people with an ileostomy

1. Dietary assessment

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1. People with an ileostomy experience digestive problems with some foods. Why these foods are avoided is not known nor is it certain whether this interferes with the nutritional adequacy of their diet.

2. A detailed dietary assessment has therefore been made of thirty-seven subjects with ileostomies and a similar number of age- and sex-matched healthy controls. All food and drink eaten over 1 week was weighed and recorded. In addition, a larger group of seventy-nine ileostomy subjects and seventy matched controls answered a questionnaire designed to identify foods which upset them and which they avoided.

3. Total nutrient and energy intakes were similar in the two groups but the subjects with an ileostomy ate less dietary fibre (g/d; mean $\pm$ SD: ileostomy subjects $18{\cdot}0 \pm 5{\cdot}9$, controls $20{\cdot}9 \pm 5{\cdot}5$; $P < 0{\cdot}05$) mainly due to lower fruit and vegetable intakes. Iron and vitamins A and C intakes were also less.

4. A majority of ileostomy subjects had a pattern of food intake different from the controls, taking more of their energy in the morning and less at night. A variety of food items upset more than half of them including nuts, pips, seeds, skins, onions, beetroot, lettuce, raw cabbage and carrot, peas, sweetcorn, mushrooms and dried fruit.

5. On the basis of the results it is possible to formulate general dietary advice for people with an ileostomy.

An often life-saving operation for people who have ulcerative colitis or Crohn's colitis is procto-colectomy with ileostomy, in which the whole of the large bowel and rectum are removed leaving the terminal ileum opening through the abdominal wall, as an ileostomy. Where the operation is performed for Crohn's colitis a variable portion of the ileum may also be involved in the disease process and may be removed. After recovery from surgery these patients lead healthy lives in general (Ritchie, 1971) although it has been reported that they experience problems after eating some foods (Thomson *et al.* 1970; Truelove & Lee, 1973; Sleisenger & Fordtran, 1978). The effect of each item of diet in individuals is unpredictable so that they are usually advised to find out by trial and error which foods upset them (Avery Jones *et al.* 1968; *British Medical Journal*, 1970). The extent to which avoidance of these foods interferes with the choice of a nutritionally-adequate diet is unknown. Furthermore, the possibility that one common underlying factor might explain their avoidance has never been explored.

One such possible factor could be dietary fibre which is largely undigested in the human small intestine. Fibre containing foods hold water in vitro (McConnell *et al.* 1974) and fibre sources such as ispaghula and sterculia increase ileostomy effluent output (Dalhamm *et al.* 1978; Newton, 1978). The physical properties conferred on foods by their cell wall structure may thus be important in determining stomal (ileostomy) function.

We have therefore measured dietary intake of a group of thirty-seven subjects with ileostomies and, using a structured interview, the food choice of a larger group of seventy-nine patients. Dietary intake and food choice has been compared with that of a randomly-selected normal population matched for age, height and sex in order to see if the patients were choosing a diet that varied substantially from that of the normal population, was adequate

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Table 1. *Clinical details of thirty-seven patients completing dietary intake study*

	Ulcerative colitis	Crohn's colitis	Total
No. of subjects	26	11	37
Male:female	13:13	4:7	17:20
Age (years): Mean ± SD	55·1 ± 12·6	38·6 ± 10·5	50·2
Range	29–75	21–55	
Period since operation (years): Mean ± SD	10·6 ± 8·8	8·3 ± 5·8	9·9
Range	0·5–34	0·5–18	

nutritionally and whether their choice of food was influenced in any way by its dietary fibre content. These observations have been used to formulate dietary advice for people with an ileostomy.

EXPERIMENTAL

Subjects and methods

Nearly all the patients who took part in the study were recruited with the assistance of the Cambridge Branch of the Ileostomy Association. This branch has members in an area bounded by King's Lynn, Diss, Bishop's Stortford and Bedford. Of the 110 requests for help which were sent out with the divisional newsletter ninety replies were received. Of these thirteen were unable to take part (two because of ill-health; two had insufficient time and nine gave no reason). Two additional patients from the stoma clinic agreed to participate making seventy-nine in all. Of these thirty-seven completed the full diet and nutritional assessment and the remaining forty-two agreed to an interview about their diet. The two groups of patients were similar in age (mean age both groups fifty years) and sex (46% male in weighed intake group *v.* 43% in questionnaire only group). Very few subjects in either group had had their ileostomy for less than one year (16% weighed intake *v.* 7% questionnaire group) and the majority in each group (60% weighed intake *v.* 69% questionnaire group) had not observed any weight change in the previous three months.

Details of the thirty-seven patients who completed the full dietary and nutritional assessment are given in Table 1. Total colectomy had been performed in all subjects except one man with ulcerative colitis in whom the colon had been left in situ. Seven further operations on the ileostomy or residual intestine had been performed on five of the Crohn's colitis (CC) patients and nine on seven of the ulcerative colitis (UC) patients. The interval between the most recent operation and the study was CC 5·7 ± 5·2 years, UC 8·9 ± 7·7 years. The amount of ileum resected and state of the residual small intestine at surgery were obtained from a detailed study of the patient's operative, X-ray and pathological records. Eight of the CC subjects had small intestinal, usually terminal ileal, involvement at the time of colectomy or subsequent operation, but all disease was considered to have been surgically excised. One subject was thought to have had ileitis as seen by contrast radiography and one had not had evidence of small intestinal disease. At the time of the study no CC subject had symptoms suggestive of active disease in the small intestine. The extent of ileal resection was 40·5 ± 40·6 cm, range 1·0–150·0 cm in the CC group and 6·4 ± 7·6 cm, range 0–25·0 cm in the UC group. Twelve of the subjects were taking codeine phosphate (6 CC, 6 UC) and two Lomotil (both CC) in an attempt to reduce effluent volume.

Thirty-six of these subjects also took part in an assessment of their nutritional and metabolic states. On the final day of the weighed dietary intake they collected all their urine

and ileostomy effluent. The following day a blood sample was taken and height, weight and skinfolds measured. Details of the results of these measurements are reported separately (McNeil *et al.* 1982).

Dietary intake study

The study was undertaken by twenty-seven ileostomy subjects between July and December 1976, and a further ten in March, 1977. After an initial home visit to explain the study, the subjects were asked to weigh and record, for 7 d, all items of food and drink as they were served, and anything left over. An explanation and demonstration of the procedure was given by S.B. in their home the day before the start, and on the first day of weighing subjects were revisited to check that they had understood the technique. Items of food eaten away from home were not weighed. Some, such as confectionery, were later bought and weighed. The subjects' detailed descriptions enabled estimated weights to be assigned to other items.

Total daily energy, nutrient and water intakes were calculated with a computer, using tables of average recipes compiled by the Department of Health and Social Security. Full details of this method of calculation have been published (Bingham *et al.* 1979).

The interview

The seventy-nine ileostomy patients were interviewed at home between July, 1976 and June, 1977. Those who took part in the dietary intake study were interviewed after completion of the weighed intake, usually on the final visit. Using a standardized schedule, arranged so that similar food items were grouped together, they were asked for their opinion as to the effect of 200 items of food on ileostomy function. Subjects were handed lists of approximately twenty items and asked whether or not the foods on the list affected their ileostomy. If so, they were asked to describe the effect, and whether it was so noticeable that they avoided the food. If there was no effect or if the subject had not eaten the food since operation, this was also recorded. Each interview took approximately 1 h, and the responses were later coded and analysed with the use of a computer. Unless otherwise stated, results refer to subjects who had actually tried the food since operation.

Control subjects

Thirty-seven healthy control subjects were matched for age, sex and height with the ileostomy subjects who took part in the full study. The controls were part of a group of sixty-three randomly-selected from the electoral register of a Cambridgeshire village whose dietary intake was measured between May and August, 1977. Virtually identical methods were used in both groups. A fuller description of the normal population and its diet are recorded elsewhere (Bingham *et al.* 1981).

The replies of seventy normal subjects, randomly-selected from the same electoral register as described previously, were used as controls for the seventy-nine ileostomy patients who were interviewed about food preferences. The interviewing schedule had the same format, but subjects were asked to state only whether or not they ate each item of food. The numbers of controls and ileostomy subjects eating each item of food has been statistically compared using χ^2 with Yates correction. All results are expressed as mean $\pm$ 1 standard deviation.

RESULTS

Dietary intake

There was no difference in total energy intake between the patients and controls, nor in energy intake as a percentage of that recommended for persons of similar age, sex and

Table 2. *Mean daily intakes of energy, water and nutrients*
(Values are means with their standard deviations)

Nutrient	Ileostomy subjects		Controls	
	Mean	SD	Mean	SD
Energy (MJ)	10·0	2·9	9·5	2·4
Morning†	2·3	0·8	1·9	0·9
Afternoon	3·3	1·0	3·0	0·9
Evening	4·2	1·8	4·6	1·2
Water (g)	2157	593	2114	747
Protein (g)	75	19	77	20
Carbohydrate (g)	293	105	270	86
Fat (g)	106	30	103	27
Calcium (mg)	1026	330	959	322
Iron (mg)	12·2	2·9	13·5	3·4*
Vitamin A (μg)	1094	572	1629	1368*
Thiamin (mg)	1·1	0·4	1·2	0·3
Riboflavin (mg)	1·5	0·5	1·6	0·6
Nicotinic acid (mg)	14·0	4·6	14·4	4·2
Vitamin C (mg)	53	25	77	41**

*$P < 0{\cdot}05$, **$P < 0{\cdot}01$.

† Energy intakes at different times of the day: morning, all food from wakening until lunch; afternoon, all food including lunch until evening main meal; evening, all food including evening meal until bed.

activity (Department of Health and Social Security, 1979). The pattern of food intake however, was different between patients and controls. Of the thirty-seven pairs of subjects twenty-eight (76%) ileostomists took more energy than their matched control at breakfast and twenty-one (57%) took less than their control in the evening. These differences were not statistically significant (Table 2).

The ileostomy subjects had lower iron, vitamin A and vitamin C intakes (Table 2). Dietary vitamin C is subject to marked seasonal variation. When vitamin C intakes of the ileostomy subjects were compared with the controls as a percentage of average seasonal intake, using values from the National Food Survey (Ministry of Agriculture, Fisheries and Food, 1978), the difference was no longer significant. There is minimal seasonal variation in Fe and vitamin A intakes, the observed differences between the groups being largely accounted for by a lower consumption of liver (2·0 g) by the patients than the controls (4·4 g).

Those with an ileostomy drank more fluid than the controls, (1643 *v.* 1508 g/d), although total water intake, in food as well as drink, was not significantly different. The differences in drinking habits were not accounted for by the weather since average atmospheric temperature for the weeks in which the patients were studied was $10{\cdot}2 \pm 4{\cdot}8°$ and was significantly lower than in the weeks in which the control survey was carried out $14{\cdot}0 \pm 2{\cdot}2°$ (t 4·68, $P < 0{\cdot}001$).

Table 3 shows intakes of dietary fibre and its components. Most of the 2·9 g difference in intake was due to lower consumption of vegetables and fruit by the ileostomy subjects. Consumption of potatoes was approximately equal (115 and 130 g for ileostomy subjects and controls respectively) but on average the controls ate more of other vegetables and fruit (g/d; 206 ileostomy subjects, 303 controls). Total cereal (including cakes, puddings, etc.) consumption did not differ appreciably (g; 257 ileostomy subjects, 239 controls). The subjects surveyed at different times of the year had similar dietary fibre intakes.

The intake of dietary fibre for the patients with Crohn's disease was $18{\cdot}9 \pm 9{\cdot}1$ g and for those with ulcerative colitis $17{\cdot}6 \pm 4{\cdot}2$ g. This difference was not statistically significant,

Table 3. *Intakes of dietary fibre and its components (g/d)*
(Values are means with their standard deviations)

	Ileostomy subjects		Controls	
	Mean	SD	Mean	SD
Total dietary fibre	18·0	5·9	20·9	5·5*
Non-cellulosic polysaccharides:	12·6	4·0	14·3	3·7*
Hexoses	7·2	2·3	7·5	2·1
Pentoses	2·6	1·1	3·6	1·4***
Uronic acids	2·7	0·9	3·1	0·9*
Cellulose	4·0	1·3	4·9	1·2**
Lignin	1·4	0·9	1·7	0·9

*$P < 0·05$, **$P < 0·02$, ***$P < 0·01$.

neither were differences in intake for any of the other items measured. Multiple regression analysis of the dietary and other data relating to the ileostomy subjects showed that energy and water intake was greater in those with more ileum resected ($P < 0·01$ in each case) and that males had higher intakes of total fibre, fibre-pentose, cereal fibre, water and energy. For the ulcerative colitis subjects alone energy intake was greater in those operated on more recently ($P < 0·01$).

The interview

Thirty-two men and forty-seven women ileostomists, mean age $50·0 \pm 14·3$ years, completed the interview. Thirty-two men and thirty-eight women, mean age $46·6 \pm 17·2$ years, were the control group. Of the ileostomy subjects 51% had had their ileostomy for more than 10 years, 37% between 1 and 10 years, and 13% for less than 1 year.

Significant differences ($P < 0·05$ or $*P < 0·01$) in food choice between the controls and patients were found. More ileostomy subjects ate cornflakes*, Special K, porridge, Rice Krispies*, Puffed Wheat, Shredded Wheat, Weetabix, Hovis, tinned spaghetti, cornflour, blancmange*, sago, tapioca, semolina*, instant potato and cocoa, than controls. Items eaten by fewer ileostomists than controls were skin of potatoes, tomatoes*, fruit*, raw carrot, cabbage, celery*, peaches*, leeks, onions, spring greens, runner beans*, lettuce, cucumber*, watercress, radishes, sweetcorn, asparagus*, broccoli, mushrooms, garlic, plums*, rhubarb, redcurrants, gooseberries, blackberries, raspberries, strawberries, grapefruit (and pith), oranges* (also pith and thick cut marmalade), raisins, prunes*, jam with seeds, walnuts, almonds, alcoholic spirits, All-bran, pickled onions*, pickles and spices. The ileostomy subjects also reported a significantly higher consumption of table salt (χ^2 82·196, $P < 0·001$) and drinks (χ^2 7·209, $P < 0·01$) than the controls.

Food items that were reported to affect ileostomy function by more than 50% of the subjects who had tried them are summarized in Table 4. Also shown is their effect and the percentage of ileostomists who avoided or modified their intake of these items in some way, for instance by eating very small portions. No cereal, animal product or drink item affected more than 50% of the ileostomists who had tried them.

DISCUSSION

Despite the good health which these ileostomy subjects enjoyed, once thay had recovered from their operation, they consumed a diet which was significantly different from an age-

Table 4. *Summary of items of food reported to affect adversely more than 50% of ileostomy subjects who had tried them*

Food items	Percentage affected	Main effects	Percentage avoiding or modifying intake as a result of effect
Nuts	60–90	Identifiable in effluent	70–90
Pips, pith, seeds, skin of fruit and tomatoes	50–90	Identifiable in effluent	50–85
Onions	50–80	Increased flow, flatus, odour-producing	50–75
Beetroot	70–80	Coloured flow, increased flow	30
Lettuce	60–70	Identifiable in effluent	50
Raw cabbage and carrot	50–60	Identifiable in effluent	50–75
Peas	50–60	Identifiable in effluent, flatus	50
Sweetcorn	50–60	Identifiable in effluent	75
Mushrooms	50–60	Identifiable in effluent, increased flow	60
Raisins, currants, sultanas	50–60	Identifiable in effluent	60–65

and sex-matched population. The main differences were a lower intake of dietary fibre containing foods, particularly vegetables and fruit, greater salt intake and a different pattern of food intake, all of which can be explained on the basis of the disturbances in physiology due to the ileostomy.

The lower intake of fruit and vegetables by the patients was due to their avoidance of food items which they felt affected adversely ileostomy function. They also ate less high-fibre cereals (All-bran, wholemeal bread, etc.) than the controls. Dietary fibre containing foods might be expected to affect ileostomy function since fibre passes through the small gut largely unchanged. It is more likely than digestible food constituents, because of its physical form, to increase the volume of, and to be recognizable in, ileostomy effluent. The selection by ileostomy subjects of an even lower fibre intake than the general population is therefore understandable. The rejection of vegetables and fruit as opposed to cereals is probably because these are the major sources of fibre in the British diet (Bingham *et al.* 1979) and not any specific differences in the effect of cereal *v.* non-cereal dietary fibre. The daily pattern of food intake also differed between the patients and controls with the ileostomy subjects taking more energy than controls in the morning and less in the evening. This feature of diet is probably acquired soon after operation in order to minimize ileal flow at night when it would disturb sleep.

People with an ileostomy vary in their sensitivity to individual items of diet. No single food adversely affected all those interviewed, although as a group they avoided more foods than the control population. What made most ileostomy subjects give up a particular food was its recognition in the effluent (Table 4). The foods which did this were mainly those with hard seed coats, well-cutinized cell walls or similar physical structure, and all were plant foods. These items of diet are not normally recognizable in faeces and so presumably undergo digestion in the colon.

Odour from food was much less of a problem than might have been imagined although some foods such as onions were noticeable in this respect. In contrast to the study of Thomson *et al.* (1970) rhubarb, fried fish and cooked cabbage did not upset ileostomy function in more than half the subjects who had tried them, although their reported ill-effects, when they occurred, were similar, namely watery flow, wind and odour. Other items causing

increased wind were onions and peas. Beetroot was noticed by the patients because it caused coloration of the effluent. Few subjects avoided beetroot subsequently but nevertheless the first experience was alarming for those who had not been forewarned. Beer increased the flow in 25%, and carbonated drinks caused wind in 40–45%, as noted by Gazzard *et al.* (1978).

Difficulty with some items of food did not interfere with the nutritional value of the average ileostomy subject's diet. Almost all consumed foods which supplied the recommended daily allowance of the various nutrients (Department of Health and Social Services, 1979) although two subjects took less than the recommended intake of 30 mg vitamin C/d. These patients had low intakes of fruit and vegetables and most of their intake of vitamin C was derived from potatoes. Freshly-harvested potatoes are an important source of this nutrient but it declines with storage so that by spring, potatoes supply only minimal quantities (Paul & Southgate, 1978).

Diet for people with an ileostomy

Freedom from dietary restriction is one of the bonuses of an ileostomy, after years of unpredictable diarrhoea. On the basis of this study and those reported elsewhere (Thomson *et al.* 1970; Hill, 1976; McNeil *et al.* 1982) it is possible to formulate some general advice for the new patient about diet:

(1) People with an ileostomy can eat a full and varied diet similar to that of the general population. No food should be excluded from the diet until first tried. Ileostomy subjects should bear in mind that many people with a normal gut avoid certain foods which do not agree with them; (2) ileostomy subjects tend to avoid dietary fibre-containing foods since they appear undigested in the effluent, increase effluent volume and flatus, and therefore require more frequent emptying of the appliance. It is also possible that they may cause colic. Food items which cause particular trouble in this regard are nuts, pips, skins and pith, raw carrot and cabbage, onions, lettuce, peas, sweetcorn, dried fruit and mushrooms. These should be eaten with caution at first and should be well chewed. Care should be taken to avoid swallowing fruit stones. Beetroot may cause discolouration of ileostomy effluent but this is harmless; (3) ileostomy subjects, especially those with Crohn's disease, lose excessive quantities of salt each day (McNeil *et al.* 1982) and therefore need above average intakes of salt and water. In hot weather particularly, they will need to add extra salt to food and take at least 1·5 l (seven cups) fluid daily; (4) certain foods are reported by people with an ileostomy to cause noticeable odour from the ileostomy. These are white fish and onions. Excessive gas production is associated with eating peas, onions and fizzy drinks; (5) as a result of their low fruit and vegetable intake some patients may have a lower than recommended intake of vitamin C particularly in late winter and spring. Fruit juices, rosehip syrup, blackcurrant and other fruit squashes to which vitamin C is added, are alternative sources; (6) patients with established ileostomies eat more in the morning and afternoon and less later in the day than controls. The new patient may prefer to follow this pattern, so as to minimize filling of the ileostomy bag at night; (7) those subjects who have difficulty gaining or maintaining weight after an operation may find food which contains energy as available carbohydrate rather than fat or dietary fibre more suitable, especially those with malabsorption.

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REFERENCES

Avery Jones, F., Gummer, J. W. P. & Lennard-Jones, J. E. (1968). *Clinical Gastroenterology*. Oxford: Blackwell.
Bingham, S. A., Cummings, J. H. & McNeil, N. I. (1979). *Am. J. clin. Nutr.* **32**, 1313.
Bingham, S., McNeil, N. I. & Cummings, J. H. (1981). *Br. J. Nutr.* **45**, 23.
British Medical Journal (1970). *Br. med. J.* ii, 634.
Dalhamm, T., Graf, W. & Nilsson, L. H. (1978). *Scand. J. Gastroenterol.* **30**, 485.
Department of Health and Social Security (1979). *Rep. on Health and Social Sub.* 15.
Gazzard, B. G., Saunders, B. & Dawson, A. M. (1978). *Br. J. Surg.* **65**, 642.
Hill, G. L. (1976). *Ileostomy: Surgery, Physiology and Management*. New York: Grune and Stratton.
McConnell, A. M., Eastwood, M. A. & Mitchell, W. D. (1974). *J. Sci. Fd Agric.* **25**, 1457.
McNeil, N. I., Bingham, S. A., Cole, T. J., Grant, A. M. & Cummings, J. H. (1982). *Br. J. Nutr.* **47**, 407.
Ministry of Agriculture, Fisheries and Food (1978). *Household Food Consumption and Expenditure:* 1976. London: HM. Stationery Office.
Newton, C. R. (1978). *Gut* **19**, 377.
Paul, S. A. & Southgate, D. A. T. (1978). *McCance and Widdowson's The Composition of Foods*, 4th ed. London: HM Stationery Office.
Ritchie, J. K. (1971). *Gut* **12**, 528.
Sleisenger, M. H. & Fordtran, J. S. (1978). *Gastrointestinal Diseases*. London: W. B. Saunders.
Thomson, T. J., Runcie, J. & Khan, A. (1970). *Gut* **11**, 482.
Truelove, S. C. & Lee, E. (1973). In *Topics in Gastroenterology*, Vol. 1. [S. C. Truelove and D. P. Jewell, editors]. Oxford: Blackwell.

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