milk, urine and caecal samples, but that, when riboflavine was placed in the caecum, riboflavine appeared by itself in urine and milk. These experiments on caecal function are being continued.

To Dr D. Robertshaw, who carried out the first operations by each of the techniques, the authors are indebted for both his help and advice.

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The One Hundred and Ninety-seventh meeting of The Nutrition Society was held at the Sir John Atkins Laboratories, Queen Elizabeth College, Campden Hill Road, London, W8, on Thursday, 14 March 1968, at 16.30 h, when the following papers were read:

Energy metabolism of young rats fed different levels of protein and/or calories. 1. The partition of the metabolizable energy intake of pair-gained and pair-fed litter-mates. By K. J. McCracken*, *Dunn Nutritional Laboratory, Infant Nutrition Research Division, University of Cambridge and Medical Research Council*

Diets containing suboptimal levels of protein have given slower growth and also decreased efficiency of energy retention than complete diets fed at the same calorie intake (e.g. Forbes, Swift, Black & Kahlenberg, 1935; Hamilton, 1939). Blaxter (1962) has suggested that at least a part of the decreased efficiency may be explained by the greater proportion of fat in the body gain of rats fed low-protein diets and the lower efficiency of fat formation compared to protein formation. However, this could not account for the large difference in requirement for energy maintenance apparent in the results of Miller & Payne (1962).

We studied the energy balance of young male hooded Lister rats maintained at 28° in continuous light and fed either a low-protein diet (5% protein from casein+methionine, 10% maize oil, 30% sucrose, 50% dextrin) or a control diet containing 20% protein with extra casein at the expense of dextrin, both diets being supplemented with mineral and vitamin mixtures.

Three treatments were compared using litter-mates starting at 55–60 g, over the

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period from 30 to 50 days of age. The low-protein diet was fed *ad lib.* (treatment A). The control diet was fed in one restricted daily ration so as either to maintain weight gain equal to that of A (treatment B) or to provide approximately the same calorie intake above maintenance as that ingested by A (treatment C). The basal metabolic rate was determined periodically after an 18 h fast. The results of a typical 21-day experiment are summarized in Table 1.

Table 1

	A	B	C
Metabolizable energy intake (1) (kcal/day)	19·5	12·3	23·2
Live-weight gain (g/day)	0·3	0·1	2·0
Gross energy gain (kcal/day)	2·5	−0·5	3·6
Calculated energy of production of gain* (2) (kcal/day)	4·2	−0·3	5·1
Calculated maintenance requirement (1)–(2) (kcal/day)	15·3	12·6	18·1
Calculated maintenance requirement/100 g body-weight (3) (kcal/day)	25·7	22·1	22·6
Basal metabolic rate/100 g body-weight (4) (kcal/day)	16·5	16·5	17·8
Excess of apparent maintenance energy over BMR/100 g body-weight (3)–(4) (kcal/day)	9·2	5·6	4·8

*Assuming 7·5 kcal/g protein formed (Kielanowski, 1965) and 15·9 kcal/g fat formed (McCracken, unpublished).

The maintenance requirement/100 g body-weight was the same for group B and C whereas that for group A was almost 20% higher. This was a consistent and highly significant finding in agreement with that of Miller & Payne (1962). This was not due to a higher basal metabolic rate nor did it seem likely that a difference in activity could be the explanation.

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Energy metabolism of young rats fed different levels of protein and/or calories. 2. Energy metabolism of rats tube-fed equicaloric amounts of complete or low-protein diets. By K. J. McCracken*, *Dunn Nutritional Laboratory, Infant Nutrition Research Division, University of Cambridge and Medical Research Council*

It had been noted in the previous experiments that the pattern of food intake was different, for the low-protein rats maintained a normal 'nibbling' pattern

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whereas the animals fed restricted amounts of the control diet became 'meal-eaters'. The work of Cohn, Joseph & Schrago (1957) suggested that this difference would alter energy utilization.

To eliminate this effect a tube-feeding experiment was undertaken. The diets were fed at two levels of energy intake, one just above maintenance (4 g/rat day) and one near the *ad lib.* intake of rats on the complete diet (6 g/rat day). The diets were mixed with water to a slurry containing approximately 0·73 g/ml dry matter and administered three times daily at 09·00, 17·00, 01·00 h.

The results are summarized in Table 1. Each result is the mean for five animals with the standard deviation.

Table 1

	Low-energy, high-protein	Low-energy, low-protein	High-energy, high-protein	High-energy, low-protein
'P' value	18·3	7·3	18·3	4·9
Metabolizable energy intake (kcal/day)	15·9	15·3	26·9	25·0
Live-weight gain (g/day)	1·3	0·6	3·8	1·3
Gross energy gain (kcal/day)	1·1 ± 0·7	1·8 ± 0·6	8·8 ± 0·5	8·1 ± 1·3
Calculated energy of production of gain* (kcal/day)	1·8 ± 0·7	2·6 ± 1·0	13·4 ± 0·9	13·3 ± 2·0
Calculated maintenance requirement (kcal/day)	14·1 ± 0·7	12·7 ± 1·2	13·5 ± 1·0	11·7 ± 2·2
Calculated maintenance requirement/ 100 g body-weight (kcal/day)	22·0 ± 1·2	21·9 ± 1·8	20·7 ± 1·2	20·0 ± 3·4

*Assuming 7·5 kcal/g protein formed (Kielanowski, 1965) and 15·9 kcal/g fat formed (McCracken, unpublished).

There was no significant difference between the calculated maintenance requirement per 100 g body-weight of any of the four groups. These values are also in good agreement with those obtained for groups B and C in the previous experiments.

It appears that differences in the apparent maintenance calorie requirement of rats fed low or normal protein levels are eliminated when both the quantity and pattern of food intake are controlled.

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Dental plaque formation on a chocolate diet. By T. H. GRENBY, *Department of Dental Medicine, Guy's Hospital, London, SE1*

It is believed that a soft, sugary diet favours the deposition of dental plaque on the teeth. Plaque formation was therefore assessed in a group of twelve male dental students who lived for 5 days on a diet which was mainly chocolate (12–16 oz daily) and skim-milk powder (3–4 oz daily). The chocolate contained between 44·8 and

56·1% sucrose. In the control experiment the same twelve students ate their normal diet for the same length of time.

Before each test period the teeth were cleaned, then stained with basic fuchsin and photographed to check that they were free from observable plaque. The students were asked not to brush their teeth during the 5-day test period. At the end of this time the teeth were again stained and photographed. The extent of heavily stained plaque was assessed on each of twenty teeth per subject, except in a few cases where teeth were missing.

The plaque scores of the same teeth on the two different diets were then compared by statistical analysis using the Sign Test. In seven out of the twelve subjects, significantly more teeth had a higher plaque score on the normal diet than on the chocolate diet. The probability did not reach the 5% level of statistical significance in the other five subjects. When the Sign Test was used on the twelve subjects instead of their 236 individual teeth, the normal diet was found to produce significantly higher plaque scores than the chocolate diet.

This finding was unexpected, because according to current theories a soft, high-sugar diet, such as a mixture of chocolate and skim-milk powder, should favour plaque formation when compared with a mixed diet containing less sugar and more fibrous foods.

My thanks are due to Professor I. Macdonald, who initiated this experiment.

The effect of undernutrition on the growth and maturation of the skeleton of the rat. By J. W. T. DICKERSON* and P. C. R. HUGHES, *Department of Growth and Development, Institute of Child Health, 30 Guilford Street, London, WC1*

Protein-calorie malnutrition retards the growth and maturation of the skeleton but there is little information about its differential effects on different parts of the skeleton. Some observations were made on rats undernourished from birth to 21 days (Dickerson & Widdowson, 1960), but no attempt was made to quantitate the degree of maturity of bones other than the femur.

The problem has now been reinvestigated using the method of Tanner & Hughes (1968) for assessing bone maturity and bone lengths from radiographs and this paper presents some preliminary results. From the 5th day after copulation female rats bearing their second litter were given 50% of the amount of food eaten by control rats on the corresponding day of gestation. Undernutrition at the same level was maintained during lactation. Male and female offspring were killed at 12 days after birth (nineteen controls and fifteen undernourished), 21 days (twenty-eight controls and thirty-seven undernourished) and at 77 days after rehabilitation

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from 21 days (eight controls and eight rehabilitated). Measurements of bone length and maturity were made from the radiographs.

No sex differences were seen in body-weight in control animals at 12 and 21 days, but at 77 days the males were significantly heavier. At 12 and 21 days the body-weights of the undernourished animals averaged only 40% of the controls, but by 77 days they had caught up to 70%.

The deficits in the length of the long bones were smaller than those of body-weight, though some bones did show greater deficits than others. The mean deficit was about 20% at 12 and 21 days and less than 10% at 77 days. The deficit in length of the pelvis was similar to that of the long bones; the deficit in pelvis width was negligible at 12 days, about 25% at 21 days and about 8% at 77 days. The larger deficit at 21 days was due to an almost complete cessation in growth in this dimension between 12 and 21 days in the undernourished animals. The difference in bone maturity score between undernourished and control groups was only significant at 12 days and 21 days. At 77 days the difference was not significant in females.

We wish to thank Professor J. M. Tanner for his helpful advice and criticism, Mr L. A. Cox for making the radiographic measurements, Miss J. A. Jarvis for care of the experimental animals and Miss M. T. Manning for computational assistance. The work was supported by a grant from the Nuffield Foundation.

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Some effects of dietary sucrose on the metabolism of liver and adipose tissue. By A. E. BENDER and P. V. THADANI, *Nutrition Department, Queen Elizabeth College, London, W8*

Many reports have been published in recent years indicating a difference between dietary sucrose and starch. The present work was undertaken to examine the biochemical effects of sucrose.

Male rats were fed on diets containing either 60% maize starch or 60% sucrose and adequate in all other respects. At the end of the feeding period they were killed by a blow on the head and the liver and the adipose tissue (epididymal fat pad) were examined in vitro for their ability to oxidize glucose and to convert glucose into fat (lipogenesis). This was done by incubating the tissues with radioactive glucose for 3 h and measuring the radioactivity of the carbon dioxide produced and the fat synthesized. The results are given in the table.

The sucrose-depressant effect was observed after as little as 14 days feeding and persisted after 109 days on sucrose diet, it was the same in females as in males, and it varied in intensity with three different strains of rats.

Table 1

Diet	Liver: Lipid count/min mg G-C-1*	Liver: Lipid count/min mg G-C-U*	Liver: CO_2 count/min mg G-C-1*	Liver: CO_2 count/min mg G-C-U*	Adipose tissue: Lipid count/min mg G-C-1*	Adipose tissue: Lipid count/min mg G-C-U*	Adipose tissue: CO_2 count/min mg G-C-1*	Adipose tissue: CO_2 count/min mg G-C-U*
Starch	49	40	172	207	27	26	19	23
Sucrose	23	18	68	133	19	19	18	18
Ratio, sucrose: starch	0·5	0·5	0·4	0·6	0·7	0·7	1·0	0·8
P (Mann-Whitney test)	0·16	0·032	0·008	0·008	0·029	NS	NS	NS

NS, not significant.
*Glucose labelled in carbon 1 or universally labelled.

The table shows that sucrose feeding alters the ratio of CO_2 obtained from [U-^{14}C]glucose to that obtained from [1-^{14}C]glucose from 1·0 to 0·7 ($P<0·02>0·01$)—indicative of an alteration in the metabolic pathways.

Serum fructose levels in men and women after sucrose and after fructose with glucose. By I. MACDONALD and L. J. TURNER, *Department of Physiology, Guy's Hospital Medical School, London, SE*1

There is evidence in experimental animals and in man that an increase in fructose in the diet, either as sucrose or as a fructose with glucose mixture, is associated with an increase in the concentration of fasting serum trigylcerides. It has also been found that a high level of serum fructose following a sucrose meal is seen in men with raised fasting serum triglycerides (Crossley, 1967).

The question then arises whether sucrose leads to a greater fructosaemia than a mixture of its constituent monosaccharides in the diet.

Ten healthy male and eight healthy female students were studied and venous blood samples were obtained before and at intervals up to 2 h after the ingestion of sucrose, given at 2 g/kg body-weight and after an equivalent amount of fructose with glucose.

The results show that from 0·5 h onwards the fructose concentration in the serum was significantly ($P=0·025–0·01$) higher after the ingestion of sucrose than after the ingestion of an equivalent amount of fructose with glucose in men and women. The glucose concentration in the serum after a sucrose meal was similar to that after a fructose with glucose meal.

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The effect of 250 ppm of copper in the diet of growing pigs on the fatty acid composition of the adipose tissue lipids. By J. H. MOORE and W. W. CHRISTIE, *Hannah Dairy Research Institute, Ayr*, and R. BRAUDE and K. G. MITCHELL, *National Institute for Research in Dairying, Shinfield, Reading*

It has been reported that the inclusion of 250 ppm of copper in the diet results in small but significant increases in the iodine value and in the oleic acid:stearic acid ratio of the back fat of pigs (Taylor & Thomke, 1964; Thomke & Taylor, 1964). Reference to soft fat in pigs fed high-copper diets has also been made by Bowland & Castell (1965). This problem has been investigated further in experiments in which groups of four to eight weaner pigs were given diets with or without a supplement of 250 ppm of copper (as $CuSO_4.5H_2O$). At slaughter at 90 kg live weight, samples of adipose tissue lipids were taken and were extracted and purified by the method of Folch, Lees & Stanley (1957).

In Expts 1 and 2, samples of whole back fat obtained from pigs given copper-supplemented diets contained slightly higher concentrations of oleic acid and slightly lower concentrations of stearic acid than did corresponding samples from pigs given the unsupplemented diets; there were no differences in the concentrations of any of the other constituent fatty acids. In Expt 3, supplementation of the diet with copper again resulted in relatively small increases in the oleic acid: stearic acid ratio in the samples of whole back fat; there was, however, a difference of 10° in the mean 'melting points' of the whole back fat of the pigs given the copper-supplemented or unsupplemented diets (29 and 39° respectively). In Expts 4 and 5, the inner and outer layers of back fat were examined separately. Supplementation of the diet with copper resulted in small increases in the oleic acid: stearic acid ratios in both the inner and outer back fat but, whereas the addition of copper to the diet did not affect the 'melting point' of the outer back fat, it was decreased by about 10° in the inner back fat. When samples of inner back fat were randomly inter-esterified, the 'melting point' of the samples from pigs given copper-supplemented diets was increased from 31 to 38°, whereas in samples from pigs given unsupplemented diets, it was decreased from 45 to 39°. Although this suggested that the differences in 'melting point' might be due to different distributions of fatty acids between the three positions in the triglyceride molecule, partial degradation of triglyceride samples with pancreatic lipase revealed no treatment differences in the composition of the fatty acids esterified in the 2-position. There remains the possibility that treatment differences occurred in the distribution of fatty acids between the 1- and 3-positions.

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Passage of food in the young suckling pig. By D. E. KIDDER and M. J. MANNERS, *School of Veterinary Science, University of Bristol*

To study the normal gut movements of the suckling pig, a number of sows with litters were housed close to the cine-radiographic equipment. Individual piglets

were picked up and given contrast medium prepared by adding Micropaque barium sulphate powder to boiling milk (1 g/2 ml). They were immediately examined under X-rays, the fluoroscope being viewed on a cathode ray tube and filmed when appropriate. After a short time of viewing the piglet was marked, returned to the sow and later re-examined radiographically for a few minutes at a time at various times for the next few days.

The contrast medium mixed well with the curds already in the stomach and the procedure seemed to cause little disturbance to the piglet, so that the picture obtained should indicate fairly accurately the normal food passage and type of gut movement in the suckling pig.

About twenty piglets were examined at ages of 1, 2 or 3 weeks. Little difference was found in the pictures at the different ages.

In general the pictures resembled those reported by Neimeier (1939) on 3–5 month-old pigs in the nature of peristaltic movements or contractions in all parts of the tract. The piglet also resembles the older pig in the entry of contrast medium into the intestine within a few minutes of ingestion, but in the piglet the contrast medium has normally all left the stomach within 1·5–2 h. These emptying times agree with those reported by Kvasnitskii (1951) using fistulated sucking piglets. The overall time taken to reach the anus was 24–30 h—considerably longer than the times of passage reported on older pigs either by radiography (Neimeier, 1939) or using markers (e.g. Castle & Castle, 1956).

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Nucleic acids in bovine nutrition. 1. Determination in digesta and the fate of ingested nucleic acids in the rumen. By A. B. McAllan and R. H. Smith, *National Institute for Research in Dairying, Shinfield, Reading*

Samples of digesta from the rumen, duodenum or ileum were homogenized at 0° with equal volumes of ethanol containing 18% trichloroacetic acid. The insoluble fraction was washed with aqueous trichloroacetic acid and lipid solvents and dried under vacuum. For RNA determination this dry residue was digested with N-KOH at 37° and the extract acidified. This procedure (Schmidt Thannhauser separation —see Munro & Fleck (1967)) converted the RNA into acid-soluble nucleotides but also rendered part of the DNA and much unknown material acid-soluble. The nucleotides were therefore retained and washed on an anion exchange column (Dowex 1X10) at pH 7·8 and then eluted with 0·5 N-HCl. They were estimated in the eluate by reaction with orcinol or by UV absorption at 260 nm. Good agreement between the two methods and satisfactory recoveries of added RNA were obtained. The soluble DNA did not interfere. For DNA determination the dry

residue was given three successive extractions with N-perchloric acid at 70° and DNA estimated in the extract according to Burton (1956). Results agreed with those obtained for total DNA (soluble and insoluble in acid) after the Schmidt Thannhauser separation and good recoveries of added DNA were obtained.

Nucleic acid concentrations in samples of rumen fluid from fistulated calves were found to be always much higher, usually at least five times higher, than could reasonably be explained by the amounts of nucleic acids ingested in the diet. Moreover, samples of pure RNA and DNA added to the rumen were very rapidly degraded; less than 10% of either was detectable after 45 min. These compounds were also degraded fairly rapidly when they were incubated with rumen contents in vitro. It appears probable, therefore, that dietary nucleic acids remain intact in the rumen only as long as they are protected within the structure of the foodstuffs and that nucleic acids in rumen fluid are almost entirely microbial in origin. This view was supported by the fact that although RNA:DNA ratios varied in different diets, the ratios after feeding these diets did not show corresponding variations.

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Nucleic acids in bovine nutrition. 2. Production of microbial nucleic acids in the rumen. By R. H. SMITH, A. B. MCALLAN and W. B. HILL, *National Institute for Research in Dairying, Shinfield, Reading*

Calves were given either a nitrogen-free synthetic diet and straw, or barley, fish meal and straw, or flaked maize and hay, or flaked maize alone, or pasture. In the rumen fluid of any one calf there was a strong direct correlation between concentrations of nucleic acid N (range 1·9–47 mg/100 ml) and total N (range 15–320 mg/100 ml). There were marked calf-to-calf variations and in four calves the proportion of nucleic acid N to total N varied from 9·5 to 15·5% (mean 12·7%). Nucleic acids in rumen fluid are largely microbial (McAllan & Smith, 1968) and micro-organisms separated from rumen fluid by centrifuging contained a fairly constant proportion (about 19%) of their total N in the form of nucleic acids irrespective of the N content of the diet given to the calves. Thus it appeared that, for the above diets, the density of the microbial population was mainly controlled by the total N concentration in the rumen and broadly, therefore, by the N intake. Such a relationship implies the conversion of a constant proportion of the N in the rumen into microbial N and for the above diets the mean conversion was apparently about 65%. The relationship was destroyed in the short term when casein (about 20 g/l. rumen fluid) was added to the rumen. Ammonia concentrations increased rapidly after such an addition but nucleic acid concentrations did not change greatly in the next 6 h suggesting only a small increase in microbial growth in this

period. When the calves were maintained on a diet containing decorticated groundnut meal the relationship was permanently disturbed; the concentration of total N in the rumen was about the same as that when the calves received pasture but the proportion present as nucleic acid was consistently lower suggesting a less efficient conversion of decorticated groundnut meal protein into microbial nitrogen.

The proportion of nucleic acid N to total N in digesta entering the duodenum paralleled that in rumen fluid but was fairly consistently lower. The difference was probably due, at least in part, to the addition of endogenous N in the abomasal secretions; comparisons of samples from the two sites marked with polyethylene glycol showed that there was no major destruction of either RNA or DNA in the abomasum. About 8–12·5% of the total N presented to the small intestine was in the form of nucleic acids.

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The digestion of energy and starch along the gastro-intestinal tract of sheep. By J. D. SUTTON and J. W. G. NICHOLSON*, *National Institute for Research in Dairying, Shinfield, Reading*

The quantitative aspects of rumen fermentation are still poorly defined. There is considerable disagreement about the proportion of the digestible energy of ruminants that is fermented in the rumen (see Warner, 1964) and also about the amount of starch that can escape rumen fermentation.

Sheep, each fitted with a rumen and a re-entrant duodenal cannula, were offered four diets (amounts in g air-dry feed/day): 450 hay, 150 dairy cubes (HM1); 90 hay, 150 dairy cubes, 200 flaked maize (CM1); 160 hay, 150 dairy cubes, 500 flaked maize (CM2); and 230 hay, 150 dairy cubes, 850 flaked maize (CM3). The diets provided approximately 81, 82, 156 and 227% of maintenance requirements, respectively (Agricultural Research Council, 1965). The first three diets were offered to three sheep, but diet CM3 was offered to two sheep only. Overall digestibility was determined by total collection of faeces for 7–10 days. Digestibility in the stomach was determined using 24 h total collection and sampling of duodenal contents (Harris & Phillipson, 1962). At least two duodenal collections were made from each sheep on each diet. Results were corrected for recovery of chromium sesquioxide administered, impregnated in paper, via the rumen fistula. Gross energy was determined by bomb calorimetry and starch by the enzyme technique of MacRae & Armstrong (1966).

The intake and digestion, along the digestive tract, of energy is shown in the table.

Assuming losses of about 8% of the ingested energy as methane and 6% of the fermented energy as heat, it can be calculated that about 52% of the digestible energy was absorbed from the stomach, probably mostly as volatile fatty acids.

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Table 1. *Intake, and digestion along the tract, of gross energy*

Diet	Intake (kcal/day)	% digested in Stomach (A)	% digested in Stomach + intestine (B)	$\frac{A}{B} \times 100$
HM1	2340	45·1	66·2	68·1
CM1	1723	56·1	82·2	68·3
CM2	3170	52·4	83·0	63·2
CM3	4768	49·1	77·7	63·1

Intake of starch on the four diets was 44·9, 168·4, 362·6 and 578·6 g/day respectively. Only 5·5, 6·8, 19·7 and 34·4 g reached the duodenum and 1·1, 0·4, 0·7 and 2·5 g were recovered in the faeces. In contrast to these results, which are in agreement with those of MacRae & Armstrong (1966), Karr, Little & Mitchell (1966) found that up to 38% of ingested starch reached the duodenum in steers.

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Milk consumption in the elderly. By A. E. BENDER and LOUISE DAVIES, *Department of Nutrition, Queen Elizabeth College, London, W8*

As a means of improving the nutritional status of the elderly it has been suggested that they should be provided with welfare milk at a reduced price. A questionnaire survey was carried out in an attempt to discover whether this would lead to extra milk consumption.

Eight hundred and twenty-one individual questionnaires (139 males and 682 females) were filled in by Health Visitors in the course of routine visits. The sample was therefore not a representative cross section but was likely to include a greater proportion of those at nutritional risk. Sixty-four per cent were over the age of 75 compared with the national average of 31% of old age pensioners; 64·7% were in receipt of supplementary pensions compared with the national average of 30%.

Most of those questioned consumed either 3·5–5 pints of milk per week (42%) or 7 pints (43%) (1 pint=568 ml); 6·4% consumed 0–2 pints and 3·2% consumed 14 or more pints per week. The average was 5·5 pints compared with 5·1 in the National Food Survey (persons over 55 years of age). When asked why they did not take more milk, 42% of the subjects said that they had as much as they wanted and 35·7% said that it was too expensive. When asked if they would take more milk if it were cheaper 46·5% said that they would. Of fifty-three individuals who took

0–2 pints per week, twenty-eight gave expense as the reason for not taking more and nine said that they disliked milk.

Thirty-four per cent of those questioned used milk only in beverages or with cereal and their average consumption was 5·3 pints compared with 5·6 pints for those who used milk in cooking as well.

Storage does not seem to be a factor limiting milk consumption. Only five persons gave storage difficulties as a reason for not taking more milk. When asked specifically 117 said that they had storage problems and another 138 had problems in hot weather but the amount of milk consumed was no less than that consumed by people who had no storage problems.

As a very rough guide to their diet subjects were asked to list their daily menus. Fifty-eight subjects (7%) did not mention a main cooked meal and did not receive more than two meals per week from the Meals on Wheels Service or a lunch club.

It is concluded that while a price reduction might possibly result in increased milk consumption it would need to be accompanied by instruction in and encouragement of the use of milk in cooking.

The Two Hundredth Meeting of The Nutrition Society was held at the Royal Society of Medicine, 1 Wimpole Street, London, W1, on Friday, 17 May 1968, at 10.30 h, when the following papers were read:

Suggested new nutritional energy units. By J. W. Lucas, *Radiation Protection Service, Manchester University* and F. Wokes, *VNRC, Garston, Watford, Herts*

In a study of the role of plant foods in solving the world food problem comparisons were made on the global scale of the annual energy intakes in group I and group II countries from plant and from animal foods (Lucas, 1968). These were of the order of 10^{15} kcal. For clearer presentation of the facts it seems desirable to introduce two larger nutrition energy units for reference purposes. One of these is 10^{6} kcal, of a similar order to the Standard Nutritional Unit (Stamp, 1960) which represents the annual energy requirement for a person with an average daily intake of 2460 kcal allowing for a loss of about 10% in bringing the food to the table. The other is 10^{12} kcal, representing the average annual energy intake of a million persons. The possible uses of such reference units will be discussed and their nomenclature, which could be based on the suggestions of Pirie (1962) will be considered.

REFERENCES

Lucas, J. W. (1968). *Plant Foods for Human Nutrition.* 1 (In the Press.)
Pirie, N. W. (1962). *Jl R. statist. Soc.* A **125**, 399.
Stamp, L. D. (1960). *Our Developing World.* London: Faber & Faber.