ABSTRACTS OF COMMUNICATIONS

The One Hundred and Thirty-eighth Meeting of The Nutrition Society was held in the Barnes Hall at the Royal Society of Medicine, 1 Wimpole Street, London, W.1, on Friday, 20 January 1961, at 2.30 p.m., when the following papers were read:

The effect of stage of growth of S 23 perennial rye–grass on the production of volatile fatty acids in the rumen of the cow.

By I. H. BATH and J. A. F. ROOK, *National Institute for Research in Dairying, Shinfield, Reading*

The amounts and proportions of the individual volatile fatty acids produced from food in the rumen of the dairy cow are known to influence the value of the food for maintenance, growth and fattening and, in the lactating cow, for milk yield and composition. As part of a wider investigation being carried out to evaluate cattle foods we have studied the effect of the stage of growth of S 23 perennial rye-grass, grazed by or given indoors to cows, on the production of volatile fatty acids in the rumen.

Stage of growth	Days on grass	Water-soluble carbohydrates in herbage (percentage of dry matter)	Ruminal pH		Total volatile fatty acids (m-equiv./100 ml rumen liquor)		Individual fatty acids in rumen liquor, molar percentages of total volatile fatty acids: Acetic acid		Propionic acid		Butyric acid		Valeric acid	
			Cows A and B given cut grass indoors											
			A	B	A	B	A	B	A	B	A	B	A	B
1	3*	8·4	6·17	5·92	11·4	12·1	64·7	67·0	18·3	19·0	14·0	10·9	3·1	3·0
2	8	7·5	5·99	5·96	12·0	12·4	62·4	65·6	20·0	19·5	14·3	11·8	3·3	3·2
3	13	10·4	6·06	6·05	12·2	12·6	63·1	64·1	20·1	21·1	13·6	11·7	3·2	3·2
4	20	18·8	6·05	6·13	12·8	12·8	58·1	58·9	25·7	22·2	13·8	16·2	2·5	2·7
5	34	13·7	5·94	6·06	13·4	12·1	61·7	60·1	22·0	22·4	13·8	14·2	2·4	3·4
6	48	12·0	6·44	—	11·6	—	63·7	—	20·1	—	13·5	—	2·7	—
7	†	20·3	6·04	6·12	11·4	11·8	58·9	60·6	23·4	19·7	14·5	17·4	3·3	2·2
8	‡	9·9	5·84	5·79	11·7	11·9	66·2	67·3	20·2	19·7	11·2	11·0	2·4	2·1
			Cows C and D grazing											
			C	D	C	D	C	D	C	D	C	D	C	D
1–3	3–13	—	5·54	5·88	15·8	13·5	58·0	61·5	22·4	19·8	15·8	14·8	3·9	3·9
4–5	20–34	—	5·60	6·03	15·5	12·9	55·8	58·2	23·9	22·1	17·6	16·1	2·8	3·7
6	48	—	—	6·26	—	13·7	—	64·0	—	21·9	—	11·9	—	2·2
7	†	—	5·67	6·07	17·2	14·9	57·8	60·0	23·3	19·8	15·9	16·6	2·9	3·6
8	‡	—	5·98	6·16	12·7	9·8	66·3	64·8	17·4	19·0	13·0	13·3	3·4	3·0

*3 April 1960. †Spring regrowth of first cutting, 27 April 1960. ‡Autumn regrowth, 28 September 1960.

The results (mean values for a 12 h sampling period) are given in the table. For cows given cut grass indoors the proportion of acetic acid in the rumen was inversely related to the water-soluble carbohydrate content of the cut grass. The proportion of propionic acid in the rumen of the cows grazing spring grass was considerably higher than that found on normal winter feeds such as silage, hay or hay plus concentrates whereas the autumn regrowth gave similar results to winter feeds which is of particular interest in relation to the nutritive value of autumn grass. At almost all times the ruminal pH was lower and the total volatile fatty-acids content higher in the grazing cows, which may be attributed to a higher herbage intake and to selective grazing.

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The effect of urea on the voluntary intake of oat straw by cattle. By R. C. CAMPLING and M. FREER*, *National Institute for Research in Dairying, Shinfield, Reading*

The effect of supplementing oat straw with urea has been investigated using three fistulated cows in a 3×3 Latin square experimental design. A comparison was made of the effect of the following three treatments on the voluntary intake of oat straw by the cows:

(1) Control—unsupplemented straw *ad lib.*
(2) Straw *ad lib.* + 150 g urea + 500 g sucrose/cow daily.
(3) Straw *ad lib.* + 150 g urea/cow daily.

Each period was of 3 weeks' duration. The nitrogen content of the straw dry matter was 0·47%. To avoid any effects of taste the supplements of urea and of urea and sucrose were given in solution as a continuous infusion into the reticulo-rumen.

The voluntary intake of straw increased by 39% when the cows were given the supplements of urea and urea and sucrose. The rate at which straw was eaten was faster when the supplements were given, while the amount of rumination per lb of food was less. Mean values are given in Table 1.

Table 1. *The voluntary intakes of oat straw, and time spent eating and ruminating*

Treatment	Voluntary intake (lb straw/day)	Time spent eating (min/lb straw)	Time spent ruminating (min/lb straw)
Control	11·9	17·7	45·1
Urea and sucrose	16·5	14·9	30·7
Urea	16·5	14·9	27·6

Further work has indicated that the amount of urea required to cause such an increase in voluntary intake lies between 25 and 75 g urea/cow daily, and that this increase was due primarily to a faster rate of disappearance of digesta from the alimentary tract of the cow. When cows ate the same quantity of straw with and without the urea supplement it was observed that the addition of urea increased the rate of breakdown of cellulose thread, and the digestibility of crude fibre in the reticulo-rumen and also increased the rate of passage of stained straw particles through the alimentary tract.

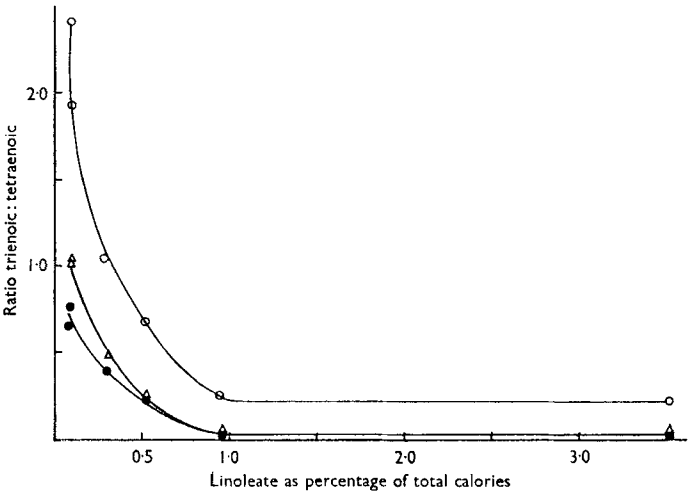
Essential fatty-acid (EFA) requirement of the pig. 2. By W. M. F. LEAT, *School of Agriculture, University of Cambridge*

Previous work (Leat, 1959) seemed to indicate that although a dietary level of 0·07% linoleic acid (expressed as a percentage of the total calories) was sufficient for growth of pigs up to 200 lb live weight, a caloric intake of 0·5% linoleic acid was required for normal skin development.

*In receipt of scholarships from the University of Melbourne and the Australian Dairy Produce Board

However an assessment of EFA status based on skin lesions is unsatisfactory, and it has been proposed that a more specific criterion of EFA deficiency is the rise in the level of 5,8,11-eicosatrienoic acid in tissue lipids (Aaes-Jørgensen & Holman, 1958). The ratio of trienoic : tetraenoic acid in tissue lipids has also been used as an index of EFA requirement (Holman, 1960).

The following experiment was therefore devised to obtain a more accurate estimate of the EFA requirement of the pig. Six gilts from the same litter were weaned at 17 days and placed on the same low-fat basal diet as reported previously (Leat, 1959), but with the exclusion of the white-fish meal. After 3 days the animals were penned individually and fed the basal diet supplemented with varying amounts of olive oil as the source of linoleic acid. The daily diets fed to each animal were equal in calorie content, the olive oil having replaced an isocaloric weight of cassava. After 21 weeks on this diet the animals were slaughtered at a live weight of 200 lb. Polyunsaturated fatty acids were estimated in various tissues, the relevant results being expressed graphically below.



Relationship between dietary linoleate and the trienoic: tetraenoic acid ratio in the fatty acids of plasma, liver and heart. ○, plasma; ●, liver; △, heart.

Using the ratio trienoic : tetraenoic acid as an index in assessing EFA status, it is seen that the pigs receiving diets with more than 0·95% of the total calories as linoleic acid showed no rise in tissue trienoic levels. This value is close to the estimated requirement for the rat of 1% of the calories as linoleate (Holman, 1960) and the recommendation of the same value as the minimum requirement for humans ((U.S.A.) National Research Council: Food and Nutrition Board, 1958).

REFERENCES

Aaes-Jørgensen, E. & Holman, R. T. (1958). *J. Nutr.* **65**, 633.
Holman, R. T. (1960). *J. Nutr.* **70**, 405.
Leat, W. M. F. (1959). *Proc. Nutr. Soc.* **18**, xxxi.
National Research Council: Food and Nutrition Board. (1958). *Publ. nat. Res. Coun., Wash.*, no. 575.

The spinal cord of pigs on low-protein diets. By A. MEYER, R. J. C. STEWART and B. S. PLATT, *Human Nutrition Research Unit, National Institute for Medical Research, The Ridgeway, Mill Hill, London, N.W.7*

The investigations reported earlier by Platt & Stewart (1960) have been continued.

It is seen from the table that in an enlarged, more amply controlled, series, chromatolysis of anterior horn nerve cells, varying in degree with the severity of the malnourished state, remains a consistent finding. It is often accompanied by an increase of oligodendroglia (around nerve cells and along nerve fibres), and by

Appearance of cells of the spinal cords of protein-malnourished and normal pigs after staining by two techniques

		Einarson's technique			Mallory's technique	
Diet*	No. of animals	Quantity of Nissl substance	Oligo-dendroglia	Astroglia	No. of fibres	Thickness of fibres
LP+CH	9	Reduced	Increased	Some activation	Increased	Definitely increased
LP	11	Reduced	Increased	Some activation	? Increased	Slightly increased
5 CLP	3	Slightly reduced	Slightly increased	Normal	Normal	Normal
N	12	Normal	Normal	Normal	Normal	Normal

*N=normal; LP=low protein; LP+CH=low protein and additional carbohydrate; 5 CLP=a diet in which casein, 5% w/w, replaces starch in the LP diet.

slight activation of astrocytes (pale and enlarged nuclei, stainable cytoplasm). With Mallory's phosphotungstic haematoxylin (after Carnoy fixation), the processes of astrocytes in the anterior horns of the more severe cases appear to be increased in calibre and, perhaps, slightly in numbers.

Chromatolysis without appreciable affection of the nucleus must be regarded as a reversible change. Likewise the glial activation need not leave permanent sequelae of appreciable severity. This is in agreement with the apparent recovery in both human and animal cases of protein malnutrition on restoration to a normal diet. Since the Nissl bodies are nucleoprotein reservoirs and glia cells may be concerned with the transfer of substances from the blood to the neurones, the histological changes in the majority of the pigs might be interpreted as being, in the first stage, adaptations to a deficient nutritive supply rather than as signs of progressive degeneration and glial replacement. More severe changes (Nissl's severe cell degeneration, oedema and heavier fibrous gliosis) do occur, however. A description of such cases will be given in a later publication, as will be the results of investigations of tissue from higher levels of the central nervous system.

REFERENCE

Platt, B. S. & Stewart, R. J. C. (1960). *Proc. Nutr. Soc.* **19**, viii.

The buccal mucosa of the African in malnutrition. By B. T. SQUIRES (introduced by B. S. PLATT), *Human Nutrition Research Unit, National Institute for Medical Research, The Ridgeway, Mill Hill, London, N.W.7*

The following observations were made upon some 2000 Tswana schoolchildren and upon a smaller number of adults, young children and infants in the Bechuanaland Protectorate during an attempt to devise a simple and cheap, even though rough, screening method for the detection of malnutrition in distant areas where regular medical surveys are impracticable.

The technique is simple (Squires, 1958). Briefly, the mucosa of the cheek is gently scraped with any suitably sized blunt instrument, and the scrapings smeared on a slide, which is then immersed in Papanicolaou's fixative before the smear dries. After fixation, the smear is ready for transport or storage for examination at leisure.

A staining method which lends itself to strict standardization must be employed; haematoxylin and eosin, Shorr's and Papanicolaou's stains have been used successfully.

In smears from a healthy subject, the superficial epithelial cells are relatively hard to detach and tend to come off in clumps; the cells stain evenly and cell membranes are well defined and a few leucocytes are usually present.

In cases of malnutrition as seen in the Protectorate, three changes appear in the picture. First, the cells tend to separate, secondly, a large proportion stain poorly and become distorted or fragmented, and thirdly, the number of leucocytes is greatly increased.

The smear changes correspond closely with the appearance of lingual and skin changes (Squires, 1958). After a good season or the institution of feeding, a normal picture returns although often not for many weeks.

The appearances are not pathognomonic for malnutrition as they are found in cases of untreated pyrexial diseases of widely different origin, e.g. tuberculosis, rheumatic carditis and human trypanosomiasis. With specific treatment the picture again reverts to normal and has been used for estimating progress towards recovery.

Non-specificity is not of the first importance in school surveys as very ill children are not likely to attend school. Initially, the method was tested upon 295 schoolchildren living in areas where medical attention was available so that smear results could be correlated with clinical findings. Both sets agreed in 243 cases (82%).

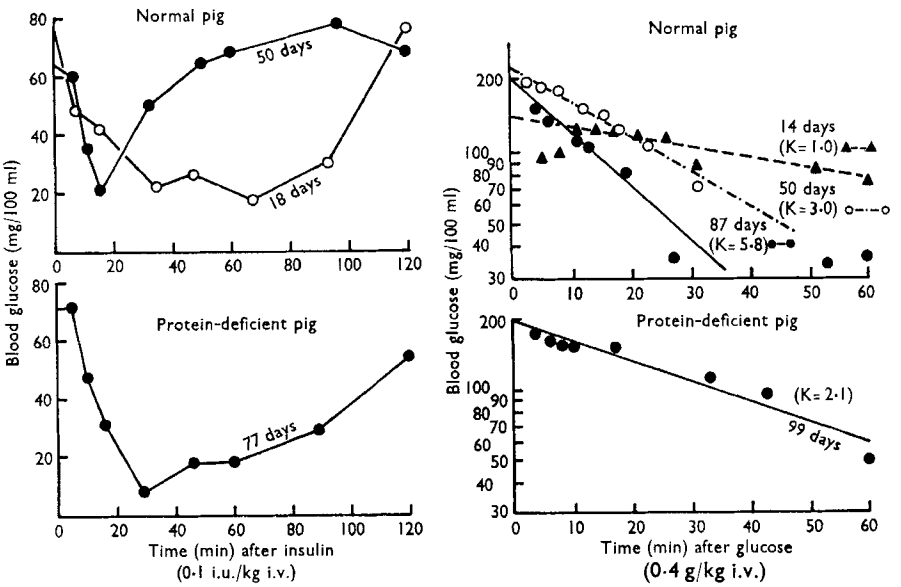
Although non-specific and at present qualitative only, the method has already proved of use in checking the health of schoolchildren in remote areas and providing information and records for the use of local authorities.

REFERENCE

Squires, B. T. (1958). *Cent. Afr. J. Med.* **4**, no. 3, p. 104.

Delayed maturation of protein-deficient pigs as indicated by response to intravenous insulin and glucose. By C. R. C. HEARD, PAMELA A. J. DURBIN and B. S. PLATT, *Human Nutrition Research Unit, National Institute for Medical Research, The Ridgeway, Mill Hill, London, N.W.7*

Prolonged hypoglycaemia following insulin (0·1 i.u./kg i.v.) and a low rate of utilization of glucose (0·4 g/kg i.v.) were found in young normal pigs. The response to insulin and the rate of utilization of glucose changes with age in pigs fed a normal diet but not in those fed low-protein diets (see Fig.). The present finding of poor glucose tolerance in protein-deficient pigs contradicts the results of oral glucose tests (Stewart & Heard, 1959) which, therefore, probably reflected defective absorption.



Delayed maturation of protein-deficient pigs as indicated by response to intravenous glucose and insulin.

Lack of glucose-6-phosphatase in the livers of very young normal pigs and in protein-deficient pigs may help to explain their inability to mobilize liver glycogen (Durbin, Heard & Platt, 1960). These defects in carbohydrate metabolism in pigs fed on low-protein diets are examples of delayed biochemical maturation resulting from protein malnutrition (Ross & Batt, 1957; Widdowson, Dickerson & McCance, 1960).

REFERENCES

Durbin, P. A. J., Heard, C. R. C. & Platt, B. S. (1960). *Proc. Nutr. Soc.* **19**, xxxv.
Ross, M. H. & Batt, W. G. (1957). *J. Nutr.* **61**, 39.
Stewart, R. J. C. & Heard, C. R. C. (1959). *Proc. Nutr. Soc.* **18**, x.
Widdowson, E. M., Dickerson, J. W. T. & McCance, R. A. (1960). *Brit. J. Nutr.* **14**, 457.

The nutritive value of pulses. By D. S. MILLER, *Human Nutrition Research Unit, National Institute for Medical Research, The Ridgeway, Mill Hill, London, N.W.7*

Increased interest is being shown in the possibility of using pulses in diets designed for the prevention of malnutrition. In a recent conference (FAO, 1958) on the use of grain legumes in Africa, Close claimed that the consumption may be as high as 400–600 g/head day of dry beans, and Aykroyd (1948) recorded a consumption of 240 g/head day in India.

Preliminary experiments showed that raw pulses, when made up into diets containing 10% protein, were often toxic. Thus, kidney and haricot beans (*Phaseolus* sp.) killed all rats in under 10 days and were considerably more toxic than raw soya-beans, about which there is a considerable literature (Platt, 1956). Toxicity may be removed by steeping the beans overnight, rejecting the water, boiling for 2 h and again rejecting the water. The net protein utilization (standardized) of ten species of beans (excluding the soya-bean) treated in this way gave a mean value of 45%: soya-bean, which is known to be richer in the sulphur amino acids, gave a value of 71%.

Measurements of this type cannot be applied directly to the expression of protein values of diets as eaten by man (Platt & Miller, 1959) and an examination of traditional dishes containing a high proportion of pulse has been carried out and the

Pulse	Origin of recipe	Dry weight grain legume (% dry dish)	Staple	Protein (%)	N.P.U.(op.) (%)	N.D-p.v. (%)
Phaseolus sp.	Pakistan	44	Rice	11·4	64	7·3
P. vulgaris	Gambia	76	—	17·7	35	6·2
P. vulgaris	Turkey	25	Wheat	18·1	43	7·8
P. vulgaris	Rhodesia	50	Maize	15·6	42	6·6
P. aureus	India	33	Rice	14·6	40	5·8
P. aureus	India	50	Rice	18·0	32	5·7
Voandzeia sp.	Gambia	84	—	17·8	38	6·8
Vigna sp.	Gambia	90	—	22·6	41	9·3
Vigna sp.	Gambia	20	Rice	14·5	58	8·4
Lens esculenta	Pakistan	45	Wheat	21·1	39	8·2
Arachis hypogaea	Gambia	19	Rice	16·2	57	9·2
Cicer arietinum	India	25	Rice	11·2	46	5·2
Cajanus cajan	Jamaica	17	Yam	15·8	52	8·2

results of these are shown in the table. It will be seen that such preparations may have a net dietary-protein value adequate for young children (6–8% N.D-p.Cals (Platt, Miller & Payne, 1961).

I would like to thank Miss H. Sheppard for much of the animal work.

REFERENCES

Aykroyd, W. R. (1948). *Spec. Rep. Indian Res. Fd*, no. 16.
FAO (1958). *Report of the FAO Techical Meeting on Legumes in Agriculture and Human Nutrition in Africa*. Rome: Food and Agriculture Organization of the United Nations.
Platt, B. S. (1956). *Chem. & Ind.* p. 834.
Platt, B. S. & Miller, D. S. (1959). *Proc. Nutr. Soc.* **18**, vii.
Platt, B. S., Miller, D. S. & Payne, P. R. (1961). In *Recent Advances in Human Nutrition*. [J. F. Brock, editor.] London: Churchill.

The relationship of the leakage of bone marrow and the staining of the legs of broiler carcasses to the bone calcification and sex of the bird.

By R. W. HOCKEN, *Spillers Limited, The Biological Unit, Middle Aston, Oxford*

The darkening of the bones of broilers on cooking has been shown to be a consequence of freezing (Shrimpton, 1960) and results from damage to the bone-marrow cells during freezing (Brant & Steward, 1950). Following an observation that bone darkening did not occur in older birds slaughtered at 14–16 weeks of age it was suggested that the increase of bone calcification with age was correlated to the leakage of bone marrow through the bone on thawing.

An experiment was carried out in which each of four rations containing various amounts and proportions of calcium, phosphorus and vitamin D (see Table 1) was given to three replicate groups, balanced for weight and sex, of twenty day-old broiler chicks, reared on wire-floored cages with individual red lighting, in an otherwise dark room.

The birds were grown to 10 weeks of age, killed and processed at a packing station: one tibia was removed for analysis and the dressed carcasses stored at −20°. After 4 weeks the carcasses were thawed rapidly, roasted and the degree of staining of the tibia scored by two individuals by visual assessment. The mean tibia ash and discoloration score of each group of birds is given in Table 1.

Table 1

Treatment	Levels of Ca (%)	Levels of P (%)	Levels of Vitamin D (i.u./100g)	Tibia ash (%) 10 weeks Male	Tibia ash (%) 10 weeks Female	Tibia ash (%) Mean at 10 weeks Uncooked	Tibia ash (%) Mean at 10 weeks Cooked	Assessment of discoloration* Male	Assessment of discoloration* Female
1	1·6	0·8	50	57·1	58·9	58·0	58·3	2·80	2·70
2	2·0	1·0	70	55·7	56·6	56·2	56·3	2·73	2·86
3	1·0	0·6	30	56·6	57·9	57·3	57·9	2·76	2·70
4	1·5	1·5	50	56·5	57·1	56·8	56·8	2·80	2·70

*The colour rating from complete discoloration to none was 1⟶5

At 10 weeks of age, the normal age at which a broiler is killed, there was no correlation between the degree of tibia discoloration and ration, tibia ash or sex, nor was there an effect of cooking on the ash content of the bone. The mean tibia ash taken as an indication of bone calcification, did not vary between groups and the overall mean of 57% was 5% above comparable published data (Fry & Stadelman, 1958).

REFERENCES

Brant, S. W. & Steward, G. F. (1950). *Food Tech., Champaign*, **13**, 533.
Fry, J. L. & Stadelman, W. J. (1958). *Poult. Sci.* **37**, 67.
Shrimpton, D. H. (1960). *Proc. Nutr. Soc.* **19**, xxviii.

Fat absorption by white bread during frying.

By MARIE M. JAMIESON, JENNIFER OXENHAM and JEAN ROBERTSON, *Food Science and Atomic Energy Division, Ministry of Agriculture, Fisheries and Food, London*

Because of the interest in fat consumption and the wide variety of fats now available, cooking tests were designed to determine if the amount of fat absorbed by

fried bread is the same when using different fats. This information is not given in published food tables. Absorption of lard, pure vegetable fat, and beef dripping was studied.

Medium-sliced white bread (average thickness 9·7 mm) was fried in each fat using an electric hot-plate set at (a) 'medium' (400°); (b) 'high' (575°). Thicker slices of bread (average 14·0 mm) of similar surface area were fried in dripping only. The central slices from each loaf were used.

Fat absorption by white bread during frying

Thickness of slice	Thin slice		Thin slice		Thin slice		Thick slice	
Fat used	Pure Danish lard		Pure vegetable fat		Beef dripping		Beef dripping	
Smoking point	182°		173°		161°		161°	
Setting on hot-plate	Medium	High	Medium	High	Medium	High	Medium	High
Average fat absorbed (g/g dry weight)	1·23 (±0·04)	0·94 (±0·02)	1·07 (±0·04)	1·05 (±0·02)	1·17 (±0·03)	1·13 (±0·02)	0·90 (±0·02)	0·96 (±0·02)
Mean moisture of fresh bread (%)	37·3	36·5	35·9	36·5	36·4	36·9	36·8	36·5
Fat absorption of fresh bread (%)	77·2	59·7	68·5	66·2	71·0	71·3	56·6	60·8
Mean moisture of fried bread (%)	4·5	9·0	4·8	7·3	5·6	6·2	12·3	11·3
Fat content of fried bread (%)	52·5	44·2	49·1	47·3	49·4	49·8	41·4	44·3

Figures in parentheses give the standard errors of the mean values.

It will be seen from the table that on a dry-weight basis the thinner slices of bread showed: (1) no significant difference in the average weight of fat absorbed due to the type of fat used; (2) the temperature of the hot-plate affected fat absorption only when using lard; (3) when the thickness of the bread was increased the average amount of dripping absorbed (again calculated on a dry-weight basis) was significantly lower.

The development of the secretion of proteases and carbohydrases in the guinea-pig. By M. J. Henschel and J. W. G. Porter, *National Institute for Research in Dairying, Shinfield, Reading*

The guinea-pig is more mature at birth than the young pig or young calf in as much as it can be successfully weaned shortly thereafter. It was of interest, therefore, to examine the level of proteases and carbohydrases in premature, newborn and young guinea-pigs in order to compare the development of the secretion of these enzymes with the pattern found in the pig and calf.

Acetone powders, separately prepared from the homogenized stomachs, small intestines and pancreases of guinea-pigs killed at the required age, were analysed for carbohydrases by measuring the increase in reducing sugar after incubating extracts of the powders with the appropriate substrate at pH 6·5, and for proteases by measuring the tyrosine released after incubation of the extracts at different pHs with freshly prepared casein. Optimum proteolytic activity in the stomach was at pH 1·8 and in the pancreas at pH 7·5.

It is apparent from the table that, unlike the newborn pig and calf, the newborn, and even the premature, guinea-pig has some ability to digest maltose and starch.

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No. of animals	Age (weeks)	Mean weight (g)	Protease activity* Stomach (pepsin)	Protease activity* Pancreas (trypsin and chymotrypsin)	Carbohydrase activity† Small intestine Lactase	Small intestine Maltase	Small intestine Sucrase	Pancreas Amylase
7	−1	50	0·012	0·013	0	40	29	25
15	0	85	0·040	0·026	180	170	35	170
14	1	130	0·11	0·13	420	450	200	550
16	2	225	0·15	0·45	410	1200	390	1500
10	3	260	0·19	0·64	170	1700	720	2500
8	4	300	0·35	0·67	0	2300	1300	2700

*m-equiv. tyrosine liberated/guinea-pig h at 37°.
†mg reducing sugar formed/guinea-pig h at 37°.

The levels of all the carbohydrases increase rapidly during the 1st week of life, but the subsequent changes in sucrase, maltase and amylase are no greater than can be accounted for by the growth of the animals. Lactase activity declines much earlier than in the pig or calf and disappears by the 4th week. The main increases in pepsin activity were in the week prior to birth and in the 1st week of life, during which the increase was more marked than in the pig or calf. The changes in proteolytic activity in the pancreas are greater than those in the pig or calf which normally have rather more activity than the guinea-pig at birth and show a gradual increase during the first few weeks of life.

An investigation of suggested physiological functions of carnitine. By A. E. BENDER and E. P. ADAMS, *Research Department, Bovril Ltd, 148 Old Street, London, E.C.1*

Carnitine (4-trimethylamino-3-hydroxybutyric acid) was first isolated from muscle in 1905, but its physiological function has not yet been ascertained. It is known to be an essential factor for *Tenebrio molitor*, in which connexion it was called vitamin B_T. Recently it has been claimed that carnitine stimulates growth in premature and poorly developed children (Canlorbe, Deltour, Borniche & Scholler, 1956; Criscione & Genoese, 1957) and experimental animals, stimulates salivary and gastric secretion (Charlier, 1955) and is involved in fat metabolism (Friedman & Fraenkel, 1955).

The influence of carnitine on growth of rats was examined and no effect found. Its effect on protein synthesis was examined by measuring N.P.U. of casein fed at 30% of the diet, i.e. at a level exceeding the animal's ability to synthesize protein. N.P.U. casein alone 30, plus carnitine 30.

Claims that carnitine is present in the phospholipids of dog serum and pancreas (Binon & Deltour, 1956) were investigated and not confirmed. The original authors have since withdrawn the claims (personal communication).

The isolated toad gastric mucosa, which responds to histamine and to water-soluble extract of muscle by increased acid secretion, did not respond to carnitine.

REFERENCES

Binon, F. & Deltour, G. (1956). *Rev. Ferment.* **11**, 14.
Canlorbe, P., Deltour, G., Borniche, P. & Scholler, R. (1956). *Sem. Hôp. Paris* (*Ann. Pédiat.*) **32**, 1780/p. 276.
Charlier, R. (1955). *C.R. Soc. Biol., Paris*, **149**, 934.
Criscione, C. & Genoese, V. (1957). *Aggiorn. pediatr.* **8**, 425.
Friedman, S. & Fraenkel, G. (1955). *Arch. Biochem. Biophys.* **59**, 491.

Some effects on hepatic lipid of varying the dietary carbohydrate intake.

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It has been shown that when adult rabbits of similar weight are put on diets containing the same amount of protein but with varying amounts of sucrose, then the amount of the hepatic lipid present when the animal has lost a third of its weight is greater with the larger sucrose intakes (Macdonald & Gharavi, 1960).

Further experiments have shown that the total amount of lipid present in the liver is related to the mean daily sucrose intakes. When other carbohydrates (glucose and maize starch) replaced the sucrose a similar relationship was found. This accumulation of liver lipid with increased carbohydrate intake is not due to deficient calorie intake. More extensive accumulation of hepatic lipid occurs with sucrose as the dietary carbohydrate than with starch.

Using silicic-acid column chromatography, the liver lipid was divided into four fractions, namely (1) sterol esters, (2) triglycerides and free fatty acids, (3) di- and mono-glycerides and free sterols and (4) phospholipids. Comparison with normal hepatic lipid showed that the composition of the lipid had altered on the excess-sucrose diet. With increase in dietary sucrose the proportion of sterol esters in the total lipid fell while that of the phospholipids rose.

When the amounts of the various hepatic lipid fractions were calculated there seemed to be a relationship between the amount of sterol esters and the mean daily sucrose intake. The other three fractions, however, all showed a significant relationship to the mean daily sucrose intake.

Thus adult rabbits on a low intake of an adequate protein together with varying amounts and types of carbohydrate show that the amount of the hepatic lipid is related to the mean daily carbohydrate intake, and the lipid present under these circumstances does not have the same composition as normal.

REFERENCE

Macdonald, I. & Gharavi, E. M. (1960). *Proc. Nutr. Soc.* **19**, xxix.

The One Hundred and Thirty-ninth Meeting of The Nutrition Society (Sixtieth of the Scottish Group) was held in the Strathcona Club, the Rowett Research Institute, Bucksburn, Aberdeen, on Friday, 17 February 1961, at 1.10 p.m., when the following papers were read:

The absorption of food from the gut of the fowl. By W. BOLTON, *Agricultural Research Council Poultry Research Centre, Edinburgh* 9

Adult male fowls were fed P.R.C. Breeders' Pellets (14·6% crude protein, 3·1% ether extract, 47·9% available carbohydrate, 5·6% cellulose) for at least 4 weeks to

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