for germ-free and conventional chicks. The meals were incorporated at a level of 50% in a purified basal diet supplemented with 10% casein, arginine, methionine and glycine. The results for groups of fifteen chicks at 11 days of age were:

	Body-wt (g)		Pancreas weight (g/100 g body-wt)	
	Germ-free	Conventional	Germ-free	Conventional
Raw meal	91	70	0·63	0·72
Heated meal	102	107	0·42	0·47

The growth depression due to raw navy-bean meal was greater in conventional than in germ-free chicks ($P<0{\cdot}001$), but the effect on pancreas weights was similar in both environments.

In a 2-week experiment conventional birds were fed the soya-bean and navy-bean diets. The results (numbers in parentheses) were:

	Body-wt (g)		Pancreas weight (g/100 g body-wt)	
	Navy-bean	Soya-bean	Navy-bean	Soya-bean
Raw meal	68 (20)	114 (20)	0·72 (16)	1·13 (10)
Heated meal	139 (19)	140 (20)	0·37 (19)	0·40 (10)

The pancreas weights suggest a lower content of trypsin inhibitor in raw navy-bean meal. It was found that an extract of raw soya-bean meal inhibited over five times as much trypsin as a similar extract of raw navy-bean meal. Extracts of the heated meals had negligible inhibitor activity. It is apparent that growth depression in conventional chicks is not simply related to trypsin inhibitor activity. Either the inhibitors in the two raw meals have different properties or a factor(s) other than the inhibitor is responsible for a large part of the growth depression. This factor appears to be more concentrated in raw navy-bean meal than in raw soya-bean meal.

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The Two Hundred and Tenth meeting of The Nutrition Society (Eighty-fourth of the Scottish Group) was held in the Rowett Research Institute, Bucksburn, Aberdeen, on Saturday, 12 April 1969, at 11.30 h, when the following papers were read:

Hydroxyproline content and cresol–red absorption as protein quality indicators respectively for meat by–products and soya–bean meals.

By A. A. WOODHAM, *Rowett Research Institute, Bucksburn, Aberdeen*

Since the publication of the first progress report of the Agricultural Research Council collaborative group on protein quality tests (Boyne, Carpenter & Woodham,

1961), tests specifically designed to evaluate quickly protein concentrates of certain types have been studied from time to time. Two such tests are the cresol-red binding test proposed by Frölich (1954) for the measurement of the degrees of under- or over-heating in soya-bean meals which was further investigated by Olomucki & Bornstein (1960), and the estimation of hydroxyproline by the method of Neuman & Logan (1950) which was suggested by Eastoe & Long (1960) as an indicator of the amount of collagen present in meat and bone meals and therefore as a possible guide to protein quality.

Values obtained here have been compared with the results of a chick growth test —the gross protein value (GPV) test (Heiman, Carver & Cook, 1939; Duckworth, Woodham & McDonald, 1961). Results are presented in Table 1.

Table 1. *Hydroxyproline contents of meat and meat/bone meals (MM) and cresol-red absorptions of soya-bean meals (SB) compared with gross protein-value* (GPV)

Code no. of sample	GPV	Hydroxyproline % of meal	Hydroxyproline % of protein	Code no. of sample	GPV	Cresol red absorbed (mg per g meal)
MM 23	91	2·76	4·87	SB 1	73	4·50
18	87	1·86	3·07	7	87	4·30
25	80	3·03	6·11	9	86	4·40
14	76	3·55	6·70	13	86	4·53
13	75	3·11	7·25	15	86	3·94
6	73	1·84	3·73	8	84	3·95
11	72	2·86	5·91	12	84	3·68
1	71	3·22	5·43	16	82	3·53
2	70	3·14	5·51	5	80	4·56
24	69	2·51	5·08	10	80	3·88
15	69	2·56	5·20	14	80	3·73
5	68	7·35	8·54	6	79	3·85
27	68	3·47	8·84	18	77	3·51
4	66	2·84	5·01	11	74	4·40
28	66	1·67	2·99	19	72	4·39
21	65	4·35	7·74	4	70	4·20
10	64	3·09	6·55	17	63	4·11
3	64	6·87	7·89	21	60	2·66
26	63	3·12	5·53	3	59	5·03
7	62	2·81	5·66			
12	61	2·81	5·31			
8	59	3·33	7·68			
30	59	3·52	7·30			
22	57	3·66	7·44			
29	56	3·05	6·18			
9	56	3·43	6·71			
19	56	1·65	2·95			
17	51	2·41	4·57			
16	39	2·13	3·56			

The hydroxyproline values are not related either to GPV or to crude protein content and it would appear that protein quality in these meat meals is not dependent primarily upon content of bone, skin and connective tissue. Chemically available lysine (ALV) estimation must be preferred for the evaluation of meat and meat/bone meals (Boyne *et al.* 1961).

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Eight of the nineteen soya-bean meals tested had cresol-red absorptions in excess of 4·3 mg/g meal, corresponding to the 'overheated' meals of Olomucki & Bornstein. SB21 corresponds to a 'much underheated' meal and was indeed one of the poorer samples. The results suggest that acceptable limits for cresol red absorption are at least from 3·5 to 4·5 mg/g meal, and it is significant that most of these samples, all obtained commercially, fall within this range.

Thanks are due to Mr A. D. McIntosh and Mr J. Anderson for technical assistance.

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Glucose entry rates in sheep given diets of barley, dried grass or hay.

By M. J. ULYATT*, F. G. WHITELAW and F. G. WATSON, *Rowett Research Institute, Bucksburn, Aberdeen AB2 9SB*

The rate of entry of glucose into the metabolic glucose pool and its rate of oxidation have been measured in three sheep given diets of barley (85% barley, 15% protein–mineral–vitamin supplement), dried grass or hay. A latin square design was used. All diets were pelleted and were given in amounts sufficient to maintain body-weight. Steady-state conditions were achieved by the use of a continuous-belt feeding device (Sutherland, Gupta, Reid & Murray, 1963; Ulyatt, 1967).

Glucose entry rates were measured by the isotope-dilution procedure of Steele, Wall, de Bodo & Altszuler (1956); D-(U–^{14}C)glucose was used as the labelling agent and was infused intravenously for 3–6 h. Expired CO_2 was collected by means of equipment similar to that described by Robbins & Bakke (1967). The steady-state specific activity of plasma glucose between min 60 and 180 of infusion and the 180 min specific activity of expired CO_2 were used to calculate parameters of glucose utilization (Bergman, 1963).

Despite large differences in the amounts of α-linked glucose polymer supplied by the diets there were no significant differences between treatments in plasma glucose concentration, in glucose entry rates, in the percentage of expired CO_2 derived from glucose or in the percentage of glucose oxidized to CO_2 (Table 1). Overall mean values for the total body pool of glucose and its apparent volume of distribution were 5·90±0·45 g and 24·7±2·7% of body-weight, respectively. The absence of any effect of diet on the rate of glucose utilization by sheep is in agreement with a recent report by Judson, Anderson, Luick & Leng (1968).

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