of cystine, in an attempt to determine whether dibenzoyl-*l*-cystine could be hydrolyzed in the organism and thus serve as a significant source of cystine for purposes of growth. To detoxicate any benzoic acid which might be formed in the hydrolysis and afford optimal conditions for observation of the growth-promoting effect of any cystine formed, glycine was also added to the diets. No evidence was obtained that dibenzoyl-*l*-cystine under the experimental conditions employed could serve as an effective source of cystine for purposes of growth.

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Effect of Methionine on Casein Metabolism.*

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Many investigators have reported that cystine stimulates growth in rats fed a ration containing casein as the sole protein. This ration is low in cystine. Mitchell,[1] Greaves and Morgan,[2] and Kik[3] have also shown that the biological value of casein, as determined by short metabolism experiments according to Mitchell's method, increased after addition of cystine.

Some years ago, Jackson and Block[4] produced evidence that methionine like cystine is capable of stimulating growth in rats fed a low cystine diet and quite recently Rose and coworkers[5] proved that methionine is an indispensable amino acid, 0.6% of which is needed in the diet for a normal increase in weight. According to them cystine is dispensable and stimulates growth only when methionine is present in too low a level.

In the present communication results are reported of a metabolism experiment with rats for determining the effect of methionine versus cystine addition on the biological value of casein for maintenance and growth, as evidenced by nitrogen balance experiments.

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1 Mitchell, H. H., *J. Biol. Chem.*, 1924, **58**, 923.

2 Greaves, E. D., and Morgan, A. F., PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 506.

3 Kik, M. C., *Ark. Agr. Exp. Sta. Bull.* 352, 1938.

4 Jackson, R. W., and Block, R. J., *J. Biol. Chem.*, 1932, **98**, 465.

5 Womack, M., Kemmerer, K. S., and Rose, W. C., *J. Biol. Chem.*, 1937, **121**, 403.

Six male rats, litter mates, 60-64 g in weight were employed for the determination of the biological value of casein fed at a 9% protein level (1.46% N in the ration). Mitchell's method was used. In the first period 3 rats were fed the casein ration, and the other 3 received the same ration and 25 mg cystine daily. In the second period all 6 rats were placed on the standardizing ration and in the third or last period 3 rats received the casein ration and the remaining 3 the same ration and 25 mg methionine daily. The results of this experiment are presented in Table I, whch shows that the average biological value for casein was 74.9; for casein and cystine 79.8 and for casein and methionine 84.0. The average true digestibility was 100, 99.3, and 100 respectively.

TABLE I.

Ration	Rat No.	Biological value, %	True digestibility, %	Increase in wt, g	Food consumption, g	Gain per g of food consumed, g	Avg
Casein	1	74.0	100.0	21	114.7	.183	
	3	70.0	100.0	30	111.8	.268	
	5	77.1	100.0	30	109.0	.267	.239
Casein and Cystine (25 mg daily)	2	81.3	97.8	31	110.0	.282	
	4	77.5	100.0	34	109.0	.312	
	6	80.7	100.0	33	105.7	.317	.303
Casein and Methionine (25 mg daily)	1	87.3	100.0	30	99.6	.301	
	3	81.4	100.0	31	99.0	.313	
	5	83.2	100.0	37	95.8	.386	.333
Casein	2	79.3	99.6	23	109.6	.209	
	4	73.5	100.0	22	105.1	.209	
	6	74.7	98.4	28	109.4	.256	.225

A study of the growth and food consumption records confirms this. The gain per gram of food consumed during the experimental period is the lowest for the casein ration, and the highest for the casein and methionine ration, while this gain is higher for the latter ration than for the casein and cystine ration.

This indicates the better utilization of food for the casein ration supplemented by methionine. With supplementation of 25 mg daily, the optimum amount of 0.6% methionine is very closely reached; the methionine content of the unsupplemented casein ration is about 0.34%. Casein contains approximately 3.2% methionine,[6] and there is 10.2% casein in the ration.

Summary. Methionine promotes the nitrogen retention of casein and in this experiment, proved even better than cystine.

[6] Tucker, H. F., and Eckstein, H. C., *J. Biol. Chem.*, 1937, **121**, 479.