

The Supplementary Effect between the Proteins of a Heat-Treated Soybean Meal ("Soma Meal") and a South African Strain of Yellow Maize Seed ("Eksteen").

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INTRODUCTION.

It has been shown by Marais (1940) amongst others, that yellow maize protein and soya bean meal protein supplement each other in tests carried out with rats. In the present study, a yellow maize seed variety called Eksteen was selected. This seed is a small, flint type, deep orange-red in colour and is one of several excellent varieties improved by selective breeding at the Summer Rainfall Cereal Experimental Station at Kroonstad in the Orange Free State (season 1941-1942). The soybean meal is a product kindly supplied by the Delmas Milling Company, Transvaal. Both these products have been separately studied and the biological values found to be on an average 63.3 for soybean meal and 69.9 for the maize seed at 8 per cent. protein level in the ration of rats (Myburgh, 1946).

The objects of this study were to determine whether these proteins had any supplementary effect on each other, and furthermore, if the two different salt mixtures used in the rations had any effect on the digestive processes and the biological values. The salt mixtures were those recommended by Hubbel *et al* (1937) and Hawk and Oser (1931). Both these mixtures of salts have been used in metabolism studies at this and other Institutes.

EXPERIMENTAL.

One biological value only was determined for each of the two rations indicated in Table 1, using two sets of Wistar rats. The detailed technique of Marais and Smuts (1940) of the method described by Mitchell (1924) was followed, except for the following modification: the N-low period followed the protein period. This procedure was also followed in previous tests. It has been found by Miller (1942) and by Myburgh (unpublished data) at this Institute, that when the N-low period precedes the protein period, higher biological values are obtained, hence the modification was an improvement. The results of this study are given in Tables 2 and 3.

RESULTS.

The biological values of the maize and soybean meal determined separately, were found to be 69.9 and 63.3 respectively, as previously stated. The average biological value for the combination of the proteins was 73.5. There was therefore a small supplementary effect. This biological value is approximately the same as that obtained by Marais and Smuts (1940), namely 75.

The choice of the salt mixture, either that of Hubbel or of Hawk and Oser, did not affect the digestion or metabolism of the protein, as indicated by the identical biological values and almost identical true digestibilities.

SUMMARY.

1. The proteins of an improved yellow maize strain popular in South Africa and that of a heat-treated soybean meal, supplemented each other to a small extent.

2. There was no determinable difference in the digestion or metabolism of the protein, when either the Hubbel or the Hawk and Oser Salt Mixtures were used in the rations with identical proteins.

LITERATURE.

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TABLE 1.
Composition of the Rations.

Ingredients.	N.—Low Ration.		Ration A.	Ration B.
	Hubbel.	Hawk & Oser.	(Hubbel Salts.)	(Hawk & Oser Salts.)
Somameal.....	—	—	10·0	10·0
Eksteen.....	—	—	40·0	40·0
Sucrose.....	10·0	10·0	10·0	10·0
Butterfat.....	8·0	8·0	8·0	8·0
Harris Vit.B.....	2·0	2·0	2·0	2·0
Cod Liver Oil.....	2·0	2·0	2·0	2·0
Hubbel Salts (1).....	2·0	—	2·0	—
Hawk & Oser Salts (2).....	—	4·5	—	4·5
NaCl.....	1·0	1·0	1·0	1·0
Dextrinized Starch.....	69·2	66·7	25·0	22·5
Whole Egg (Ether-extracted).....	3·8	3·8	—	—
Agar.....	2·0	2·0	—	—
TOTAL.....	100·0	100·0	100·0	100·0
% N.....	0·6	0·6	1·45	1·46

(1) *Science* (1931) 74,369. (2) *J. Nutrition* (1937) 14,273.

TABLE 2.
Nitrogen Metabolism Data. Calculation of the Biological Value.

Rat No.	Initial Weight.	Final Weight.	Average Weight.	Daily Food Intake.	Daily N Intake.	Daily Faecal N.	Metabolic N.		Food N in Faeces.	Absorbed N.	Daily Urinary N.	Endogenous N.		Food N in Urine.	Retained N.	N Balance.	Apparent Digestibility.	True Digestibility.	Biological Value.	Percentage Net N—Utilization.
							Per Gm. Food.	Per Day.				Per 100 Gm. Weight.	Per Day.							
1	105	114	110	7.0	101.5	23.9	Mgm. 2.31	Mgm. 16.2	7.7	93.8	44.6	Mgm. 18.4	Mgm. 20.2	24.4	69.4	33.0	76.5	92.4	74.0	68.4
2	106	115	111	7.5	108.7	25.6	Mgm. 2.01	Mgm. 15.1	11.5	97.2	46.0	Mgm. 16.8	Mgm. 18.6	27.4	68.8	37.1	76.5	89.6	71.9	64.5
3	107	114	111	7.5	108.7	21.4	Mgm. 2.01	Mgm. 15.1	6.3	102.4	41.8	Mgm. 15.7	Mgm. 17.4	24.4	78.0	45.5	80.2	94.1	76.2	71.6
4	115	122	119	8.0	116.0	20.9	Mgm. 2.40	Mgm. 19.2	1.7	114.3	50.1	Mgm. 19.0	Mgm. 22.6	27.5	86.8	45.0	81.8	98.6	76.1	75.1
5	120	127	124	8.0	116.0	24.1	Mgm. 2.30	Mgm. 18.4	5.7	110.3	52.4	Mgm. 14.5	Mgm. 18.0	34.4	75.9	39.5	79.3	95.2	68.9	65.6
6	99	107	103	7.0	101.5	23.52	Mgm. 2.30	Mgm. 16.1	7.4	94.1	42.8	Mgm. 17.6	Mgm. 18.1	24.7	69.4	35.2	77.0	92.18	73.8	68.4
AVERAGE.....																78.5	93.8	73.5	68.9	

Whole Maize (Eksteen)—Somameal "Ration A" (N = 1.45 per cent.).																				
1	116	120	118	7.7	—	17.8	Mgm. 2.31	—	—	—	—	—	—	—	—	—	—	—	—	—
2	116	121	119	7.7	—	15.45	Mgm. 2.01	—	—	—	—	—	—	—	—	—	—	—	—	—
3	118	121	120	7.7	—	15.45	Mgm. 2.01	—	—	—	—	—	—	—	—	—	—	—	—	—
4	128	128	128	8.2	—	19.7	Mgm. 2.40	—	—	—	—	—	—	—	—	—	—	—	—	—
5	133	138	136	8.7	—	20.0	Mgm. 2.30	—	—	—	—	—	—	—	—	—	—	—	—	—
6	111	117	114	7.2	—	16.55	Mgm. 2.30	—	—	—	—	—	—	—	—	—	—	—	—	—
N-low Period.																				

TABLE 3.
Nitrogen Metabolism Data. Calculation of the Biological Value.

Rat No.	Initial Weight.	Final Weight.	Average Weight.	Daily Food Intake.	Daily N Intake.	Daily Faecal N.	Metabolic N.		Food N in Faeces.	Absorbed N.	Daily Urinary N.	Endogenous N.		Food N in Urine.	Retained N.	N Balance.	Apparent Digestibility.	True Digestibility.	Biological Value.	Percentage N—Utilization.
							Per Gm. Food.	Per Day.				Per 100 Gm. Weight.	Per Day.							
7	103	111	107	7.0	102.2	21.9	Mgm. 2.21	Mgm. 15.4	6.5	Mgm. 95.7	46.8	Mgm. 16.6	Mgm. 17.7	29.1	66.6	33.5	78.6	93.6	69.6	65.2
8	112	120	116	8.0	116.8	27.1	Mgm. 2.24	Mgm. 17.9	8.2	Mgm. 107.6	52.0	Mgm. 18.6	Mgm. 21.6	30.4	77.2	37.7	76.8	92.2	71.8	66.2
9	102	109	106	7.0	102.2	23.4	Mgm. 2.02	Mgm. 14.1	9.2	Mgm. 92.9	39.6	Mgm. 16.8	Mgm. 17.8	21.8	71.1	39.2	77.1	91.0	76.6	69.8
10	131	140	136	8.5	124.1	25.3	Mgm. 2.13	Mgm. 18.1	7.2	Mgm. 116.9	54.1	Mgm. 18.7	Mgm. 25.4	28.7	88.2	44.7	79.6	94.3	75.5	71.2
11	90	98	94	7.0	102.2	24.1	Mgm. 2.74	Mgm. 19.1	5.0	Mgm. 97.2	47.2	Mgm. 21.2	Mgm. 19.9	27.3	59.9	30.9	76.4	95.1	72.0	68.6
12	91	100	96	7.0	102.2	25.2	Mgm. 2.12	Mgm. 14.8	10.4	Mgm. 91.8	38.4	Mgm. 16.5	Mgm. 15.8	22.6	69.2	38.6	75.4	90.0	75.4	68.0
Whole Maize (Eksteen)—Somameal "Ration B" (N = 1.46 per cent.).																AVERAGE.....	77.3	92.7	73.5	68.2
N-low Period.																				
7	116	121	119	7.2	—	15.9	Mgm. 2.21	—	—	—	19.8	Mgm. 16.6	—	—	—	—	—	—	—	—
8	123	126	125	8.2	—	18.4	Mgm. 2.24	—	—	—	23.2	Mgm. 18.6	—	—	—	—	—	—	—	—
9	117	121	119	7.7	—	15.6	Mgm. 2.02	—	—	—	20.0	Mgm. 16.8	—	—	—	—	—	—	—	—
10	144	152	148	8.7	—	18.5	Mgm. 2.13	—	—	—	27.7	Mgm. 18.7	—	—	—	—	—	—	—	—
11	96	100	98	6.5	—	17.8	Mgm. 2.74	—	—	—	20.8	Mgm. 21.2	—	—	—	—	—	—	—	—
12	103	109	106	6.7	—	14.2	Mgm. 2.12	—	—	—	17.5	Mgm. 16.5	—	—	—	—	—	—	—	—