The Amino-Acid Composition Of Certain Tropical Pulses and Cereals

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It is generally agreed that a deficiency of good quality protein is extremely prevalent, and is the most significant form of malnutrition in most of the regions of the subtropics and tropics. Its seriousness has been emphasised by the frequency with which kwashiorkor (Infantile Pluricarencial Syndrome) occurs in these areas.

Between the time when breast feeding alone is nutritionally adequate and the time when the older child can obtain, digest and assimilate the full adult diet is the period of most critical need and greatest danger. Since many of these areas have a very low per capita availability of animal products as sources of protein of superior quality, attention must be given to finding vegetable protein combinations of good quality.

Three simultaneous measures should be urged for poorer tropical mothers during this critical age period (Jelliffe, 1955): (i) Use of *all* available animal protein including milk, cheese, eggs and fish preparations; (ii) Prolonged breast feeding (up to about two years); (iii) The development and use of inexpensive, locally available and easily digestible vegetable protein combinations which can be prepared as a gruel or paste for infant feeding.

Efforts to develop such preparations are greatly handicapped by the very scanty knowledge of the amino-acid content of many of the promising foods of tropical and subtropical areas. With a particular interest in their possible use as infant foods of vegetable origin, the senior author collected samples of a number of pulses and cereals in different parts of the Eastern Mediterranean, South-East Asia and the Western Pacific. These have now been analysed for their content of protein and four key amino-acids by the Institute of Nutrition of Central America and Panama (INCAP).

The content of the following nutrients was determined in each sample: protein (N x 6.25), moisture, tryptophane, lysine, methionine and cystine.

Methods

The samples were ground in a porcelain mortar to a fine powder and kept in tightly closed screw-cap jars at room temperature during the duration of the analyses. Moisture was determined by the A.O.A.C. method recommended for cereal foods (1950). The determination of nitrogen was done as recommended by Hamilton and Simpson (1946). The amino-acids were estimated by microbiological assays. *Lactobacillus arabinosus* 17-5§ was used for the determination of tryptophane by the method of Wooley and Sebrell (1945) with the modification that, prior to enzymatic hydrolysis, the material was autoclaved at 15 pounds for 30 minutes with 75 ml. of water and the assay medium was prepared according to Greene and Black (1944). The determination of lysine using *Leuconostoc mesenteroides* P-60‡ and of methionine using *Lactobacillus arabinosus* 17-5 were done according to the methods described by Horn *et al* (1946, 1947). Duplicate analysis at four different concentrations were run for each sample.

Results

The results are shown in Table I. It is hoped that they will be used for the development of appropriate vegetable protein mixtures for

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§Culture No. 8014, American Type Culture Collection, Georgetown University Medical School, Washington, D.C.

‡Culture No. 8042, American Type Culture Collection, Georgetown University Medical School, Washington, D.C.

TABLE I. AMINOACID AND NIACIN CONTENT OF TWENTY-ONE SAMPLES OF CERTAIN TROPICAL PULSES AND CEREALS*

No.	*Scientific name*	*English name*	*Local Name*	*Country of origin*	*Moisture g./o*	*Nitrogen g./o*	*Niacin mg./100g.*	*Trypto-phane g./o*	*Lysine g. o*	*Meth-ionine g./*	*Cystine g./o*
1**	Cicer arietinum	Chick pea	Hommos	Beirut, Syria	13.0	2.89	0.96	0.10	1.43	0.31	0.36
2**	Triticum vulgare	Wheat preparation	Burghul†	Beirut, Syria	13.4	2.13	3.81	0.07	0.43	0.30	0.32
3	Phaseolus mungo	Black gram	—	Madras, India	13.0	3.52	1.49	0.19	1.77	0.50	0.28
4	Phaseolus aureus	Green gram	—	Madras, India	12.7	3.65	1.85	0.17	1.03	0.16	0.27
5	Cicer arietinum	Chick pea Bengal gram	—	Madras, India	13.2	3.14	1.00	0.11	1.48	0.26	0.22
6	Dolichos biflorus	Horse gram	—	India	11.8	3.52	2.37	0.12	1.64	0.58	0.36
7	Lens esculenta	Lentil	Mysore dhal	Madras, India	12.4	3.68	1.51	0.04	1.70	0.35	0.41
8	Eleusine coracana	Finger millet	Ragi	Madras, India	10.4	0.93	0.70	0.04	0.22	0.18	0.14
9	Cicer arietinum	Chick pea Bengal gram	Chola	Madras, India	11.4	3.00	1.26	0.19	1.52	0.40	0.45
10	Phaseolus radiatus	Green gram	Mung dhal	Calcutta, India	11.8	3.60	1.33	0.20	1.75	0.56	0.28
11	Phaseolus mungo	Black gram	Kalai dhal	Calcutta, India	11.6	3.76	1.77	0.19	1.74	0.51	0.30
12	Oryza sativa‡	Rice	—	Chengmai, N. Thailand	11.9	1.36	6.60	0.03	0.31	0.22	0.21
13	Vigna unguiculata	Cow pea	—	Chengmai, N. Thailand	13.0	3.95	1.99	0.18	1.67	0.53	0.42
14	Glycine max	Soya bean	—	Chengmai, N. Thailand	11.3	6.75	1.90	0.43	2.28	0.78	0.74
15	Oryza sativa§	Rice	—	Manila, Philippines	14.3	1.41	2.00	0.07	0.33	0.15	0.19
16	Glycine max‡	Soya bean	—	Singapore, Malaya	10.6	6.40	0.77	0.29	2.04	0.82	0.88
17	Phaseolus vulgaris	Kidney bean	Red pea	Jamaica	11.6	3.12	1.64	0.10	1.44	0.36	0.22
18	Vigna catiang	Black-eyed pea	Black-eyed pea	Jamaica	9.4	3.67	1.44	0.14	1.31	0.42	0.35
19	Vigna unguilata	Cow pea	—	Jamaica	10.3	3.49	1.64	0.13	1.49	0.71	0.29
20	Phaseolus lunatus	Lima bean	—	Jamaica	10.6	3.66	1.38	0.16	1.54	0.39	0.42
21	Cajanus indicus	Pigeon pea	Congo pea	Jamaica	10.0	3.27	2.25	0.08	1.51	0.44	0.37

* All collected in October and November, 1953, except 17–21, which were collected in April, 1954. All in dried form as bought by housewife in market.

† *Burghul:* a traditional wheat preparation used in Syria and the Lebanon. Made by boiling grain until it swells, but is not cooked, then dried, coarsely ground and stored.

**Mixtures used for infant feeding in Arab refugee camps.

‡ Black variety. § Red variety.

child feeding. The present data indicate that a *number of these foods might be suitable for this purpose,* although other often complex, considerations will be of importance, including digestibility, cultural acceptance, price, results of animal and human feeding trials, etc.

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