THE ANALYSIS OF CEYLON FOODSTUFFS

II.—SOME IMPORTANT CEREALS, PULSES, OILSEEDS, AND ROOTS

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THE analytical data presented in this article relate to the more commonly-grown grains, pulses, oilseeds and roots, and some of their products. The grains include rice, polished and partly polished (country rice), kurakkan, maize, Guinea corn (sorghum), Italian, kodo, bulrush and little millets, and adlay. The analysis of rice polishings is included as this material is of high food value. The pulses examined were green, black, and red gram (dhal), cowpeas, soybean, and horse gram. Of these, soybean is at present not cultivated in Ceylon on any scale, but as experiments are in progress to enable this useful crop to be more generally cultivated, a sample grown at Peradeniya was analysed. Of the oil seeds, only coconut, gingelly and cashew nut have been examined. Coconut milk, obtained from the scrapings of the kernel by expression with water, the form in which coconut is most widely used in Ceylon cookery, has been included for comparison. The roots analysed include manioc (cassava), its flour and starch, king yam so popular in the Northern Province, sweet potato, and arrowroot flour and starch. Seeds of the water lily (*olu*), used in the remoter parts of the North-Central Province where rice is scarce, and of jak, largely used for food where this crop grows successfully, have also been examined.

In all samples of over thirty different food products have been studied analytically. The constituents determined were moisture, protein, ether extract (fat), fibre and mineral matter, and carbohydrate, by difference. The calorific or heat value was calculated in the usual way. The results of analysis are shown in table I. In table II the calcium and phosphorus contents of the three most commonly consumed foodstuffs, rice, kurakkan, and green gram, are shown. The analyses were made by the standard methods.

TABLE I

Analyses of Locally-grown Foodstuffs

Name	Botanical Name	Sinhalese Name	Tamil Name	Moisture.	Protein	Carbo-hydrate	Ether Extract (fat)	Fibre	Mineral Matter	Calorific Value per 100 Grms
Cereals—				Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Rice (polished)	Oryza sativa	Haal	Arisi	13·24	6·31	78·14	0·38	0·33	1·60	341·2
Rice (country)	—	Meratahaal	Naddarisi	13·24	7·44	77·28	0·73	0·33	0·98	345·5
Rice (polishings)	—	Kuddu	Thavidu	9·03	11·91	36·22	23·51	9·21	10·12	404·1
Kurakkan	Eleusine coracana	Kurakkan	Kurakkan	12·36	7·61	74·76	1·35	1·57	2·35	341·6
Maize	Zea mays	Bada iringu	Cholam	12·81	7·20	73·76	3·99	1·20	1·04	359·8
Guinea corn (millet)	Sorghum vulgare	Karal iringu	Irringu	9·38	7·57	74·93	3·92	1·31	2·89	365·3
Italian millet	Setaria italica	Tanahal	Sami	11·09	11·31	60·81	4·83	8·50	3·46	332·0
Kodo millet	Paspalum scrobiculatum	Amu	Varagu	12·29	7·54	68·60	3·37	5·31	2·89	335·0
Bulrush millet	Pennisetum typhoideum	Kambu	Kambu	11·37	12·07	65·39	5·77	3·38	2·02	361·8
Little millet	Panicum miliare	Meneri	Pannichami	11·81	11·43	59·75	3·08	8·95	4·98	312·4
Adlay (husked)	Coix lachryma-jobi	Kirindi	—	10·77	8·87	70·34	5·56	0·83	3·63	366·9
Sanwa millet (husked)	Echinochloa colona frunemtacea	Gojerawala	Pulsami	8·78	9·52	77·64	2·66	0·16	1·24	332·6
Pulses—										
Green gram	Phaseolus aureus	Muneta	Payaru	12·08	21·70	57·70	0·96	3.33	4·23	326·2
Black gram (husked)	Phaseolus mungo	Undu	Ulundu	13·41	22·99	59·42	1·12	0·01	3·05	339·7
Red gram (dhal)	Cajanus cajan	Parippu	Parippu	11·11	21·29	63·01	1·00	1·08	2·51	346·2
Cowpeas	Vigna unguiculata	Me	Paiyittangkoddai	10·88	26·82	52·35	1·10	4·94	3·91	326·6
Horse gram	Dolichos biflorus	Kollu	Kollu	9·23	21·13	59·79	0·79	5·62	3·44	330·8
Soybean	Glycine hispida	—	—	13·02	37·01	27·89	14·23	2·90	4·95	387·7
Oil seeds and products—										
Coconut (fresh)	Cocos nucifera	Pol	Thengai	41·32	3·10	20·20	34·02	0·50	0·86	399·4
Coconut milk	—	—	—	52·01	4·01	15·90	27·00	—	1·08	322·6
Gingelly	Sesamum indicum	Tala	Ellu	5·54	20·14	16·59	50·76	2·44	4·53	603·8
Cashew nut	Anacardium occidentale	Kaju	Kasukkoddai	5·43	18·60	38·10	35·15	0·31	2·41	543·2
Seeds—										
Water lily	Nymphaea nouchali	Olu	Thamarai	12·05	7·95	77·86	0·94	0·68	0·52	351·7
Jak	Artocarpus integra	Kosetta	Pilakoddai	52·10	4·62	41·20	0·66	0·16	1·26	189·2
Roots and root products—										
Manioc (Cassava)	Manihot utilissima	Manyokka	Maravalli	67·83	0·81	29·63	0·58	0·71	0·44	127·0
Manioc flour	—	—	—	12·90	2·18	80·24	1·58	1·91	1·19	343·9
Manioc starch	—	—	—	11·56	0·20	88·15	—	—	0·09	353·4
King yam	Dioscorea alata	Raja valliya	Raja valli	71·23	1·73	25·43	0·03	0·62	0·96	108·9
Sweet potato	Ipomoea batatas	Batala	Vatthalai	81·01	1·40	15·99	0·22	0·17	1·21	71·5
Arrowroot flour	Maranta arundinacea	Areluk	Arrodduma	15·27	0·40	83·77	0·15	—	0·41	338·0
Arrowroot starch	—	—	—	14·13	0·46	85·20	—	—	0·21	342·6

Before discussing the results, it should be emphasized that the analytical figures shown are those obtained for the particular sample of foodstuff analysed. Other samples would show variations in composition within limits. This would be clearly seen from a reference to Sen's Paper on Indian Feeding Stuffs (1). As the samples selected for analysis were fairly representative, the figures furnished may be considered to be typical of the different food materials. The data obtained are considered below.

Cereals.—Of the cereals examined, rice and particularly polished rice has the highest starch and lowest protein and fat contents. Country rice is superior in these respects to polished rice. The millets are comparatively richer in proteins and fat, but they have also fairly high fibre contents when unhusked. Their carbohydrate percentages generally are comparatively lower and they are therefore somewhat better balanced foods than rice. Adlay is rich in proteins and fat, some samples being particularly so. One such examined in this laboratory gave a protein content of 17·5 per cent. Burkill (2) states that the protein content of adlay varies from 9·5 to 23·0 per cent. From its analytical composition, it would be inferred that adlay is a nutritious grain, well worth cultivating. Its use is being popularized in the Philippine Islands (3). Kurakkan and maize are not very dissimilar in composition, but the latter has an appreciably higher fat content. Rice polishings are rich in proteins and very rich in fat and can be usefully incorporated with rice flour in proportions of one to four or five of flour, in the preparation of local foods. Whole grains are superior to highly-milled grains, not only in food value but also in vitamin B 1. The calorific values of the cereals examined are very much the same, except for *meneri* which is appreciably lower.

Pulses.—The pulses are characterized by being rich in protein, and one of them, soybean, in fat as well. This pulse is a very nutritious food, having the highest protein content of all vegetable foodstuffs. The protein contents of all the other pulses average 23 per cent., while that of soybean is 37 per cent. Their calorific values are similar to those of the cereals.

Oilseeds and Products.—Gingelly is the most nutritious of the oilseeds examined, being richest in oil and protein. It has the highest calorific value of all the foods examined. Coconut is rich in oil, but poor in protein. Coconut milk of good quality contains about 27 per cent. oil and 4 per cent. protein. Cashew nut is a nutritious nut second only to gingelly in protein and oil contents and calorific value.

Seeds.—The seeds of the water lily (*olu* S.) are similar in composition to village rice, being high in carbohydrates and having a fair content of protein. Hence its use instead of rice

in the remoter dry zones. Jak seed is mainly a carbohydrate food, being rich in this constituent. The dried seed has a composition similar to that of rice.

Roots and Root Products.—Manioc, sweet potato, arrowroot, and king yam are rich in carbohydrate and have low protein contents. They are essentially starchy foods and ill-balanced. When used in the diet they should be supplemented with protein foods. The dried flours are of high calorific value.

TABLE II

	Calcium (Ca) Per cent.	Phosphorus (P) Per cent.
Rice (country) (2)	0·018	0·39
,, (polished) (2)	0·012	0·32
,, (hill) (2)	0·015	0·32
Green gram (3)	0·165	0·38
Kurakkan (3)	0·371	0·26

In table II above are shown the mineral analyses of samples of rice, green gram, and kurakkan. The figures in brackets indicate the number of samples examined. The values quoted are the means of those obtained. The analyses indicate that local rices are poor in calcium but rich in phosphoric acid. Country rice is superior to polished rice in both constituents. Kurakkan is rich in lime, but comparatively poor in phosphoric acid. Green gram is rich in phosphoric acid, but has not such a high calcium content as kurakkan.

SUMMARY

The analytical data of 30 locally cultivated cereals, pulses, oilseeds, and roots indicate that cereals are richer in carbohydrates but poorer in protein than pulses. Of the former, the millets generally and adlay are better balanced foods than rice or maize. The local roots are mainly carbohydrate foods. Oilseeds are rich in oil or fat and some like soybean and cashew nut in protein as well. The former is the most nutritious of all the vegetable foods. The two other seeds examined are similar in composition to rice being particularly rich in carbohydrate.

REFERENCES

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