



COLONIAL OFFICE

NUTRITION IN THE BRITISH WEST INDIES

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PREFACE

At the first Conference of the United Nations' Food and Agriculture Organisation recently held in Quebec, it was generally agreed that the member nations should make every effort to relieve hunger and malnutrition by directing supplies of food where they were most needed, by stimulating production and by ensuring that the best use, from the nutritional point of view, was made of the foodstuffs available. It was recognised that the methods followed during the war in the United Kingdom and other highly developed countries might not be applicable to the conditions found in less developed territories, where a different approach might have to be adopted. One method suggested was the selection of typical areas for experimental development, to serve as training grounds and working models for demonstration purposes.

The report presented here shows how the nature of a territory's nutritional problem may be determined by a simple and rapid clinical examination of suitable population groups, and the value of its food supplies in relation to human needs be assessed. It also shows that, in areas at the stage of development represented by the Caribbean territories, certain immediate measures for the improvement of nutrition can be recommended without hesitation (paras. 23-47), while other problems require the kind of attack outlined in the proposal for a Nutrition Working Party (paras. 60-73).

I take this opportunity to correct certain misinterpretations of my recommendations which have received some publicity, and which have arisen because material used for purposes of particular discussions during my tour has been considered out of its context. In particular, the basic diet, by means of which I demonstrated the merits of supplements which could be provided in various ways, has been called a recommended diet. It will be clear from para. 23 of this report that this misinterprets my intention, but it was not possible for me to present the complete picture until I had finished my tour and was able to examine all the evidence, setting out my recommendations in the context of a full report.

Finally, I wish to express my appreciation of the helpfulness and interest I encountered everywhere, without which the data for this report could not have been assembled.

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ERRATA

Cover.—for “Councii” read “Council”.

Para. 5(b). Page 2.—in lines 1 and 4 for “biliary” read “liver”.

Para. 45. Page 9.—for “Including” read “Included”.

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NUTRITION IN THE BRITISH WEST INDIES

Background of Visit.

1. My visit to the Caribbean Territories during the winter of 1944-45 marked the resumption of visits to Colonial Territories begun in East Africa before the war. In that earlier work, my starting point had been the emphasis laid by the Research Sub-Committee of the Committee on Nutrition in the Colonial Empire on the need for surveys to correlate state of nutritional health with food intake. In East Africa the work was planned to include a study of the relationship of the state of health and food intake to resources—to agricultural production in particular—as well as to other aspects of social and economic life.* Later, as the result of the experience in dealing with food policy on an over-all basis which I gained while serving as joint secretary of the Scientific Food Policy Committee of the War Cabinet, I urged the adoption of a similar approach in colonial food policy.† This was eventually agreed in principle by the official acceptance by Colonial Governments of the findings of the United Nations Conference on Food and Agriculture.

2. My examination of conditions in the West Indies during my recent visit may be regarded as a first attempt to apply to colonial nutrition problems this accumulated knowledge and experience, on the lines laid down at the Conference (3) (4).

Statement of the Problem in the British West Indies.

3. The task fell under four main heads:—

(a) To determine the extent to which malnutrition exists;

(b) To determine what steps, compatible with the long term measures which are likely to be decided on when the necessary facts are known, could be put in hand immediately to eliminate at least the clinically detectable evidences of nutritional deficiency;

(c) To point out the need for finding ways and means of raising the general level of nutrition to obtain optimum physiological efficiency, in so far as this can be achieved by good feeding—there being evidence that for this it is necessary to feed on a higher nutritional plane than is required merely to eliminate clinical signs of malnutrition;

(d) To interest the departments and agencies concerned in securing and collating the facts on which to base a plan for food management, and to impress the need for integration of effort in evolving and implementing such a plan.

Evidence of the Extent of Malnutrition.

4. The evidence obtained in the course of visits as shown in Appendix I was derived from several sources.

(a) *Hospitals and institutions*, where it was possible to get some indication, if only qualitative, of the prevalence of florid deficiency disease;

(b) *Examination of school children*, the principal source of information. This population group is accessible, representative and easy to handle, and because of the effect of the stress of growth on the state of nutrition, signs of malnutrition are likely to show up early;

(c) *Examination of pregnant and nursing mothers*, not such an easy group to handle but again likely, because of the stress factor, to show signs of deficiency incipient in the population as a whole;

(d) *Information on the working efficiency of labour*;

(e) *Dietary studies*, either by direct observation of meals or by evaluation of food supplies for the territory as a whole.

* See (1), para. 404.

† See (2), p. 12.

5. The following conditions were found in *hospital and institution populations*:—

(a) *Nutritional oedema*—probably identical with famine or starvation oedema and the oedema of low protein diets. Actually seen in hospital in St. Kitts, Jamaica and Puerto Rico, occurring in infants and young children of mothers who, generally being unmarried, had to support themselves and their babies by working in the urban areas or on plantations and elsewhere. Breast-feeding was therefore scanty and the infants' diet consisted mostly of carbohydrate, e.g. arrowroot, cereal gruel or even sugar and water. This is a sociological rather than a nutritional problem, and the treatment of these cases can at best be only a palliative.*

(b) *Biliary cirrhosis with ascites*—a number of examples seen in Jamaica. It is thought they may be sequelae from cases of nutritional oedema where inadequacy of protein has caused liver damage which, on repair, gives rise to a biliary cirrhosis with impaired liver function, leading to accumulation of fluid in the abdomen.

(c) *Pellagra*—seen in Barbados, in St. Michael's Hospital, and in the lunatic asylum, where, however, it had been successfully treated with nicotinic acid. Cases were also seen in Jamaica.

(d) *Extreme anaemia*—quite common in the hospital in Georgetown, British Guiana; no doubt associated with infestation with malarial parasites and hookworm, but also occurring in pregnancy.

(e) *Keratomalacia*—an eye disease due to vitamin A deficiency. One case seen in the ophthalmic department in Barbados.

(f) *Hypo-riboflavinosis*—one subject with all the signs well developed was seen in a wayside market in a coastal village in British Guiana. He was a mental defective, the son of a poor widow.

6. The results of the *examination of school children* are tabulated in Figs. 1 and 2, and a note on the size and nature of the samples examined will be found appended to Fig. 1. The number of children examined in each territory is admittedly small; for Puerto Rico especially, it represents a very small fraction of the total child population. From observations of a general character, however, I had no reason to suppose that the samples examined in detail were anything but representative of the child population as a whole. In the time at my disposal I could not do more than a simple clinical examination. This method reveals the main features of the problem sufficiently clearly for present purposes and is in my view a better approach than that involving elaborate laboratory work on blood and urine.

7. Fig. 1 shows the incidence of clinical signs which may be regarded as signs of nutritional ill-health. A full discussion of their significance cannot be undertaken in a report of this kind, but must be reserved for the glossary of signs of nutritional ill-health which is being compiled. There are, however, a few points which should be stressed in regard to the interpretation of Fig. 1.

8. In the first place, some of the signs listed may not be directly due to dietary insufficiency, though dietary factors may be underlying and contributory causes. Various other factors such as infection, infestation with parasites, or trauma, may be directly responsible for the presenting features of the lesion. Secondly, even when directly related to the poor nutritional value of the diet, the signs may not be related specifically to a shortage of

* As a result of my visit, an investigation into the medical aspects of this problem has been arranged, and Dr. J. Waterlow, a member of the staff of the Human Nutrition Research Unit, is paying a visit of several months for this purpose.

a particular nutrient. For example, dryness and changes in the follicles of the skin may result from insufficiency of one of two or more factors. (15) (16).

9. We are nevertheless accustomed to consider certain of these signs as being indications of shortages of certain factors, and it is usual to regard the following as features of vitamin B₂ deficiency:—

Hypochromotrichia
 Photophobia
 Lachrymation
 Blepharitis
 Folliculosis
 Dyssebacia
 Some of the colour changes in the tongue
 Changes in the papillae of the tongue
 Stomatitis
 Cheilosis
 Cracked skin.

There is, however, reason to think that some confusion exists in experimental work between the effects of B₂ vitamins and those of certain amino acids, and it may be that *some* of the effects ascribed to shortage of B₂ vitamins will ultimately be found to be due to a shortage of certain essential amino acids. I suspect that this may be the case with some of the skin changes like xerosis, loss of elasticity, and some of the follicular changes—especially those grouped under the term "permanent gooseflesh" (P.G.F.). It may also be that the incidence of ulcers of the skin of the leg will prove to be related to the level of nutrition in respect of certain amino acids.*

10. I am impressed with the association found between the incidence of evidences of vitamin B₂ (and/or protein) deficiency, such as these skin changes, and the conjunctival changes grouped under "excess tissue, grades 1, 2 and 3".

11. The signs listed in Fig. 1 also include changes in the gums which are generally regarded as evidence of an insufficiency of vitamin C, and certain changes in the skin and eyes, such as follicular keratosis and Bitot's spots respectively, which are usually ascribed to vitamin A deficiency. Signs of rickets were also occasionally found.

12. The conclusions to be drawn from Fig. 1 may be summarised as follows:—

(a) The samples examined revealed no striking differences between the territories. With one reservation, this coincides with the impression I had gained during my visits before I was able to analyse my results. The reservation is that the contrast between well and poorly nourished children was very much more marked in Puerto Rico than in the British territories. That is to say, the condition of the well nourished Puerto Rican children was on the whole better than that of the corresponding children in the British territories, but those who were poorly nourished showed more definite and severe signs of deficiency than was usual in the latter.

(b) It will be seen that the signs usually attributed (in our present state of knowledge) to vitamin B₂ deficiency predominate among those listed in Fig. 1, and that these signs also show the heaviest incidence among the children examined.

(c) The incidence of dental defects was high.

* See further in Appendix II.

(d) Some gross anaemia was seen, so severe that it was obvious even in a quick clinical examination of this kind. It is therefore likely that laboratory studies of the blood would reveal a much higher prevalence of anaemia.

(e) The incidence of gum changes of the kind usually attributed to insufficiency of vitamin C was on the whole low, except possibly in British Guiana where it will be seen that 5-7 per cent. of the children were affected.

(f) Signs of rickets were rare, and there was very little evidence of vitamin A deficiency. Only occasionally was a child seen with Bitot's spots, or follicular keratosis of the kind generally ascribed to vitamin A deficiency.

13. Fig. 2 shows the heights and weights of all the children examined, compared with those of London County Council school children in 1905-12 and 1938 (17). It will be seen that heights show a rate of growth comparable with that of the London children of the present day, but weights are somewhat lower. This conclusion for the combined curve in general holds good for the individual territories visited.

14. The numbers of *pregnant and nursing mothers* seen were insufficient to offer any figures for the incidence of malnutrition in this group, but some good examples were found of the same clinical signs as were prevalent among the school children.

15. Only one group of *labourers* was actually examined systematically. Employers in general complained that labour was inefficient and worked as few hours as possible, just enough in fact to earn a bare subsistence. It was pointed out that if wage rates were increased the number of hours worked fell correspondingly, so that the amount earned remained the same. In an interesting sociological study of an East Indian village in Trinidad, carried out by one of the Social Welfare Officer's staff, similar observations were made. It was found that the length of the working day was limited by fatigue. After working all morning and into the early afternoon, the labourer and his wife returned home so tired that, even if they had cultivable land, they left it almost entirely untouched because, they said, they had no energy left to tackle it.

16. It is well known that people on a low calorie intake, i.e. suffering from sheer shortage of food quite apart from any effect of the quality of the diet, exhibit a generally "difficult" mental attitude. The following passage refers to experiments undertaken by Benedict on student volunteers, i.e. men who were originally co-operative in outlook.

"Comment is practically unanimous as to the change in mental attitude and disposition accompanying the reduction in diet. The men were more irritable, more easily annoyed by each other and by outside associates. As they expressed it, they were more 'crabbed'. They recognised it themselves, and others recognised it. Those who had not known them before the beginning of the experiment and who formed opinions of them during that period were surprised to discover the difference after the men had begun eating uncontrolled. The men joked about their own irritability only because they recognised it and believed it to be a temporary condition from which they would rally when the food reduction was passed." (5)

17. Further evidence on this point was obtained in investigations conducted during the war.

18. The *dietary evidence* obtained was of three kinds.

(a) *Qualitative observations* made during visits to homes and markets. The most important conclusion drawn from these was that, by and large, the population lived from hand to mouth, chiefly on account of poverty.

Observation in the homes confirmed qualitatively what is shown more clearly by analysis of the quantitative data obtained, for certain territories, on food supplies from home resources and imports. A point of some importance was that some at least of the East Indians were employing cooking methods likely to conserve food values and flavours better than the methods used by the West Indians.

(b) Data on *school feeding*, which will be discussed later, see paras. 54-59.

(c) *Examination of food resources* for Barbados, Jamaica and Trinidad. An estimate of the food supplies of these three territories for the latest year for which figures were obtained will be found in Table I. It has been compiled from a number of sources with the help of officers with local knowledge, and provides an interesting example of the extent to which, as a result of the war, it is now possible to arrive at an appreciation of a territory's total food supply, including local production. Evaluation of these supplies in terms of Calories per head per day (see Table IV) suggests that, with the probable exception of Jamaica, there are unlikely to be any considerable gaps in the statement.

19. In Table II the food supplies shown in Table I are summarised by categories, on a per head per day basis and making allowance for the inedible portion. It will be seen that the extent to which starchy roots and fruits are used in place of cereals varies widely from one territory to another; the amount of energy (Calories) supplied by these two categories together is, however, approximately the same in each case.

20. In view of the recommendation I shall be making about flour, it is necessary to get some idea of the changes in cereal consumption which have occurred during the war, so that my recommendations may be put forward in relation to normal rather than to abnormal consumption. The collection of data on local food production having only developed during the war, import figures alone are available for the pre-war period. All the wheat flour used in the three territories under examination is imported, and the same holds good for rice except in Trinidad. Table III shows the imports in 1937 compared with those in 1944 (or 1942), and the interesting fact emerges that there has been remarkably little change in flour consumption per head. The total quantities imported have, however, increased in both Jamaica and Trinidad, particularly in the latter where there has been a heavy influx of population. We must therefore conclude that so far, at least, as these three territories are concerned, no marked change in flour consumption is to be expected when food supplies return to normal. Rice, on the other hand, shows marked decreases in imports per head in all three cases, and also in the actual amounts imported into Trinidad.

21. The next step is the evaluation of the dietaries, the results of which will be found in Table IV where they are compared with the nutrient values taken as an immediate objective in the sense of the Report of the Hot Springs Conference.* The comparison is also shown diagrammatically in Fig. 3. Evaluation on a per head basis assumes equitability of distribution, which of course does not occur, but it serves as a first over-all approach to the problem and shows up the principal shortages. These are here found to occur in

- (a) the B₂ vitamins, especially riboflavin;
- (b) calcium;
- (c) protein (Barbados and Jamaica).

* See (2), p. 11. The values adopted here are discussed in Appendix III. Food values used in the dietary evaluations are taken from (6), except wheat flour, for which figures for flour made from Manitoba wheat have been used.

Reference to paras. 6-12 will show close correlation between the conclusions arrived at by clinical examination on the one hand, and this stock-taking of the territories' food resources on the other.

22. Fig. 4 shows the distribution of nutrients in these dietaries; further details will be found in Appendix IV.

IMMEDIATE MEASURES RECOMMENDED

23. An attempt has been made in Table V to draw up two type dietaries, based on low and high flour consumption respectively, in terms of foods normally available in the area and taking account of the food habits of the people. These have been evaluated and the results set out alongside the amounts of nutrients in the immediate objective (see first part of Table VI, and Fig. 3). It will be seen that they fall short of even this limited objective in protein (Type A), calcium, iron and the B vitamins, but they serve as a starting-point for planning immediate measures for improvement.

"Ennobled" * Wheat Flour.

24. The second part of Table VI shows how the gaps can be filled, in part at any rate, by using a *long extraction flour* and making certain additions to it. If the desire for a white or only slightly off-white loaf is taken into consideration, the choice of length of extraction will be limited, but an 80 per cent extraction flour can be made to meet this requirement. An 80 per cent. extraction flour is, therefore, recommended on both aesthetic and nutritional grounds, and the evaluation has been made on that basis.† The flour should be "ennobled" by the addition of up to 3 per cent. of food yeast, a calcium salt and possibly also iron. Trials have been made of the addition of 0.5 per cent. bone meal as a source of calcium.

25. It is necessary to emphasise the importance of the part played by the longer extraction flour, as distinct from the supplements added to it, in making good the nutrient shortages shown in Table IV and the first part of Table VI. A diagram (Fig. 5) brings out clearly that in protein, iron and vitamin B₁ the lengthening of extraction rate makes a contribution as great as, or greater than, the supplements proposed. It has also to be remembered that the extra protein fraction retained has a special biological value.

26. The use of *food yeast* in preference to individual vitamins will provide a supplement of the whole B complex instead of certain components only; this is a matter of importance. For technical reasons it may possibly be found advisable not to go beyond 2 per cent., but there is evidence to show that up to that level the addition of food yeast would involve neither technical difficulties nor adjustments of any moment in baking practice.

27. An estimate of the relative cost in Jamaica of a number of foodstuffs in terms of riboflavin and nicotinic acid gives some striking results. From Table VII it will be seen that, in respect of riboflavin, skimmed milk solids rank next to food yeast in cheapness but even so, in this form the riboflavin is no less than 7 times as expensive; in the form of fresh milk it costs 13 times as much as in food yeast, in certain kinds of pulses 15 times, and in fresh beef 32 times. For nicotinic acid the ascending order of cost is—certain types of pulses, 10 times; fresh beef, 11 times; skimmed milk powder, 100 times.

* There is evidence that the nutritive value of foodstuffs is enhanced by certain treatments which include soaking, germination and fermentation (9). Micro-organisms play an important part in the enhancement of food value by these means, and the processes by which the increase is brought about can be called "biological ennoblement". Procedures of this kind suggested the use of the term "ennobled" to describe wheat flour to which food yeast had been added, thus differentiating it from flour enriched or fortified by the addition of synthetic vitamins.

† Canadian Vitamin B White Flour (78 per cent.) could if necessary be used instead.

Groundnuts, being exceptionally rich in nicotinic acid, would probably be a cheap source of this vitamin, but price data are lacking. It should be noted that meat and milk prices are lower in Jamaica than in some other Caribbean territories; the table therefore shows these products in a more favourable light than would be the case elsewhere, e.g. in British Guiana, where riboflavin from fresh beef would cost about 90 times as much as from food yeast, and nicotinic acid roughly 30 times as much.

28. The method adopted in the United States for introducing specific nutrients into flour, viz. enrichment with individual factors, is not recommended. The chief reason for preferring lengthening the extraction rate together with ennoblement to enrichment is that there is good reason to think that where measurable factors of the vitamin B₂ complex are deficient, other factors which are not yet measurable—and some which still remain unknown—will be deficient too. Since some at least of these are known to be important for health, a policy of enriching a low extraction (i.e. white) flour with two only of the B₂ group of vitamins must be regarded as unsatisfactory. Food yeast supplies the whole complex, and in addition the value of even a small amount of yeast protein in supplementing other proteins, especially cereal proteins, should not be overlooked.

29. No direct comparison in cost between ennoblement and enrichment can yet be made. At the particular rates of enrichment selected by the United States viz.:—

thiamine (aneurin)	...	...	...	...	...	2 mg./lb.
riboflavin	...	...	...	...	...	1.2 mg./lb.
niacin	...	...	...	...	...	16.0 mg./lb.
iron	...	...	...	...	...	13.0 mg./lb.

the cost of the enriching ingredients in 1944 is stated to have been 8 cts. per 100 lbs. of flour and the officially recognised overall cost, 12 cts. per 100 lbs. of flour.(7) On the assumption that food yeast will cost 6d. per lb. and flour £2 3s. 9d. per bag of 196 lbs. as in Jamaica at present, the ingredient cost of ennoblement with 2 per cent. food yeast (allowing for replacement of an equivalent weight of flour) would be about 10 cts. per 100 lbs.*

30. Trials made with a *bone meal* from which all soup extractives have been removed have given very satisfactory results from the point of view of palatability, baking quality and so on. It is possible, however, that there may be objections on other grounds to the use of bone meal, and in that event calcium carbonate would be a suitable alternative. It should be added at the rate recommended by the Scientific Food Policy Committee in the United Kingdom, viz. 14 oz. to a bag of 280 lbs. This is approximately 1.4 g. per lb. (0.3 per cent.) or 10 ozs. to a bag of 196 lbs.

31. *Reduced iron* should also be added if the ennobled flour does not reach a minimum of 13 mg. per lb. The evaluation shown in Table VI does not, however, include any supplementary iron, since the values for 80 per cent. Manitoba flour with 2 per cent., and 3 per cent. food yeast are 13.3 and 14.1 mg. per lb., respectively.

Skimmed Milk Powder.

32. It is an important principle that reliance should not be placed on a single procedure to make good dietary deficiencies, and therefore the measures taken should not be confined to improving the nutritional quality of the flour. The use of skimmed milk powder should be extended, the greater part of the supplies preferably being directed to priority groups, especially school children. A palatable and popular method of presentation has to be found, and

* Taking \$1=5/-.

experience in the United Kingdom suggests trying some mixture like National Milk Cocoa, about which further information will be found in Appendix V.

33. There is every reason to believe that, except for fat and the fat-soluble vitamins A and D, skimmed milk powder contains all the nutrients found in fresh milk (see App. VI), all of which are especially valuable in human nutrition. At the same time, the need for butter-fat and its fat-soluble vitamins is not so urgent in the West Indies as in more temperate climates. Fats and oils can be produced more readily from plant sources in the tropics; the prevalence of sunshine allows vitamin D to be readily synthesized in the human bodies exposed to it; and for supplies of vitamin A, the consumer can turn to such rich sources of its precursors as red palm oil and green leafy materials or other vegetables such as yellow sweet potatoes.

34. Objections are raised from time to time against the use of skimmed milk powder, based on the belief that its importation will interfere with the development of local dairy industries. The Committee on Nutrition in the Colonial Empire examined the matter thoroughly in 1938 and reached the conclusion that in fact there was little danger of harmful competition.*

Pulses and Groundnuts.

35. Attention should further be given to increasing the production and consumption of pulses and groundnuts, and at the same time the range of pulses used should if possible be enlarged, taking into account nutritional value in deciding on the best varieties to be grown. It can safely be said that any immediate steps taken in this direction will be in line with the requirements of long-term food policy, when the necessary investigations and collation of data shall have made the latter clear.

36. Besides the B₂ vitamins as shown in Table VII, the pulses provide roughly 100 g. of protein per lb. and useful amounts of calcium and iron. More detailed information will be found in Appendix VI.

Green Leafy Vegetables.

37. In the longer term programme I should like to see increased consumption of green leafy vegetables, either fresh or processed in such a way as to retain as far as possible their nutritional value. They are of special value in the diet as sources of essential amino acids, vitamin A precursors and some of the B vitamins, see especially riboflavin in Fig. 4 and Appendix IV. In so far as the proposals for the immediate period should be the beginning of the long term measures, a start ought to be made at once on increasing the consumption of this group of foodstuffs.

Rice.

38. A relatively small improvement in a foodstuff regularly and widely eaten often makes a more effective contribution to nutrition than what may appear to be more spectacular measures. It is for this reason that special attention has been paid to flour; and in so far as rice is also used as a staple, consideration should be given to the best method of handling this, so as to retain the maximum nutrient value in every respect, combined with good digestibility and aesthetic and keeping qualities. When all the various ways of preparing rice are explored, by far the most satisfactory from every point of view, including the nutritional, is found to be parboiling in some form or another.† Investigations are now being made into various aspects of the technique of parboiling, with a view to obtaining the best product, from the nutritional and the commercial aspects.

* See (1), paras. 174 & 258.

† See my memorandum, *Rice and its importance for human nutrition*, (1), App. 6, for a full discussion of the matter.

Poor Dieteries.

39. The problem of the dieteries falling below the average shown in Tables III-VI requires special examination. In Table VIII a hypothetical poor dietary within the general feeding pattern of the Caribbean territories is compared with the immediate objective and the corresponding (low flour) type dietary from Table VI.

40. In correcting dieteries of this type, the first and most obvious step to be taken would be to increase the total amount of food consumed so as to supply adequate *energy value*. This increase should preferably be shared between "ennobled" flour, pulses and animal protein and should not be achieved by augmenting the consumption of starchy roots, which is already at a high level.

41. Turning to *protein*, it will be seen that with a severe drop in the total "protein" goes a striking change in the proportions derived from cereals on the one hand and starchy roots and fruits on the other. In the poor dietary, 14 g. come from cereals and 18 g. from the starchy roots and fruits, compared with 23 g. and 13 g. respectively in the type dietary. The roots supply about 50 per cent. of the total "protein" in the poor dietary against roughly 23 per cent. in the other. In view of what I have said above in para. 9, this point may prove to be important.

42. On several grounds it seems probable that there is a shortage of *vitamin A* or its precursors in many of the poorer dieteries, and it is necessary to look for some way of making good such a shortage in some less costly manner than by the use of cod liver oil. As already indicated in para. 33, a good source of vitamin A alone is required, vitamin D not being generally needed in view of the amount of sunshine. A possible source of vitamin A is red palm oil, a small plantation of which has already been established in British Guiana. It is true that there are production difficulties to be overcome, but every effort should be made to find some way of making available this useful source of the vitamin. On the dietary side, it may be mentioned that red palm oil was successfully introduced to East African populations not previously accustomed to it by making it an ingredient of a vegetable substitute for ghee. This consisted of 1 part of red palm oil (deodorised) to 5 parts of vegetable cooking oil.

43. The B vitamins in the poor type dietary are lower than in the type dietary, but it is interesting and at first surprising to find that they are as good as the average values arrived at for Barbados (Table IV). The explanation lies in the large amounts of starchy roots and fruits required to provide the equivalent, in energy value, of a given amount of cereals; their lower B vitamin values per oz. are thus offset by the greater quantities consumed. Cf. Appendix VI.

44. The provision of additional B vitamins has already been discussed (paras. 24-38), but it should be pointed out that the benefit to be derived from improved flour would be small if and so long as intake was only 2½ ozs. as shown in the poor type dietary.

Improvement of Cooking Methods.

45. Including among the short-term measures for improving the diet should be the extension of good methods of cooking. Some are already in use, e.g. among the East Indians in their treatment of vegetable dishes and mixed dishes of vegetables with small quantities of fish, shrimps or meat. The more general adoption of their methods of conservative cooking would do a great deal to improve the nutritional level of the West Indians. I found instances of two groups getting much the same diet in terms of raw food-stuffs, but where, owing to differences in cooking methods, it is probable

that the actual intake of the less stable nutrients was very much higher in the one than in the other.

Equitability of Distribution and Needs of Priority Groups.

46. In calculating requirements and intake in the tables presented above, equitability of distribution has been assumed. This, of course, is an oversimplification.

47. The immediate programme for improving nutritional health should include such measures as price control of foodstuffs on the one hand and carefully planned facilities for collective feeding on the other, to the extent that may be necessary to ensure that a dietary of good nutritional value is within the reach of all consumers and that the needs of priority groups are met. The latter comprise sections of the population for whom more than a minimum of essential nutrients is required on account of heavy work, growth, pregnancy, lactation or disease. Their special needs must be allowed for in estimating the food supplies required for the community as a whole.

LONG-TERM PROGRAMME

48. Up to this point my recommendations have been confined to immediate measures designed to bring the nutrient intake in the British West Indies up to the level of the immediate objective, at which such evidences of malnutrition as can be detected clinically will no longer occur. It is unlikely, however, that feeding at this level only will secure optimal physiological efficiency; for this reason, it will be necessary to plan the utilisation of resources in such a way as to secure a still better food supply, with safeguards for distribution so that priority groups will get their physiological requirements and the diet of even the poorest will be satisfactory.

49. Facts are required as a basis for this long-term planning; this generally means that investigations need to be made to discover the facts. There is no doubt that improvements will entail a programme of increased production, particularly of animal products, which are relatively costly to produce compared with plant foodstuffs. The basic question to be answered is, which combination of crops, i.e. food and economic crops, will give the best return in terms of land and labour in relation to nutrient requirements? Expressed in another way, a balanced diet must be worked out in relation to a balanced agriculture and in terms of a balanced trade.

50. The points which need to be emphasised in framing a long-term nutrition programme are relative costs in terms of land and labour, the introduction of new varieties, and the application of modern food technology.

51. Relative costs have to be considered in relation to food crops on the one hand, and crops to be sold for money with which to purchase food on the other. There is little information on this point about most relevant food crops, as it has so far received scarcely any attention from agricultural scientists. Such data as may at present be available for native crops usually refer to their cultivation under present conditions. The work of experimental agricultural stations gives good reason for believing that with the cultivation of improved varieties, the proper use of fertilisers and better farming methods, the returns from land and labour would substantially improve. The introduction of new varieties may present difficulties; for example, greenstuffs satisfactorily established in the United States suffered considerably, when introduced into Puerto Rico, on accounts of pests, damage due to heavy rain and so on. Moreover, the community may have to be educated over a period of time to accept new types of foods, or foods differently presented; and it should be recognised that the nature and amounts of crops, and their processing and cooking, must be related to the food habits and preferences of the people.

52. The food picture might be completely changed if, in addition to these measures, production were concentrated in the best growing season, and the methods of modern food technology applied, although it might still be necessary and desirable to produce certain perishable food crops locally. There is no doubt, however, that at present there is considerable waste of effort in trying to secure fresh supplies all the year round by cropping in off seasons with resultant partial and often total failure. This should not be read as conflicting with any programme designed to extend the period during which a satisfactory return for labour may be expected, thus spreading productive agricultural effort over a greater part of the year, e.g. by control of water. But it does offer an escape from unproductive labour on out of season crops and—a point of some importance—the prospect of some spare time to devote to productive secondary industries.

53. The point mentioned above about the importance of relating new foods to food habits should also be made in regard to foods presented in new ways. This may best be given as part of the education of children at school.

School Meals.

54. In the course of my visit, it seemed to me that in many ways a first attack on long-term problems could be made in the schools. I had been specially asked to advise on school meals schemes, and there are a number of arguments in favour of making school meals the starting point for a long-term nutritional programme. Children are the most receptive population group, as well as being the section which will give the best returns in improved nutrition for improved feeding. At the same time, new methods of food production can be demonstrated in school gardens. A good deal of interest in school meals already exists locally, and in view of this, and also the growing emphasis placed on school meals in the more advanced countries, the development of a satisfactory service in that respect is a matter in which public opinion may be expected to bring some pressure to bear.

55. After examining the schemes at present in operation, I came to the conclusion that all the bad features commonly found in large-scale catering in the United Kingdom were, if anything, worse in the West Indies. The chief desiderata and problems of large-scale catering may be summarised as follows:—

- (a) Prevention of loss of flavour and deterioration in appearance;
- (b) Service of food really hot;
- (c) Provision of the large amount of equipment needed;
- (d) Heavy labour costs of preparation, and the need of skilled staff and supervision;
- (e) Need of a well planned supply system behind the catering organisation if the menu is to be varied all the year round.

56. I found that a measure of success has been achieved in the West Indies, where the problem is one of feeding comparatively small numbers in the care of comparatively highly skilled personnel. For the most part, however, schemes suffer from lack of organised production, the absence of which compels over-dependence on two or three staple commodities; poor kitchen help; primitive and inefficient equipment; and shortage of expert personnel. In general, the large-scale equipment is merely the equipment of the home kitchen magnified in some respects but without proportionate magnification of heating devices, so that dishes which should cook in a few minutes for the best flavours and food values have, in fact, to cook for hours.

57. In view of these weaknesses, I advised against extension of the school meals organisation in the West Indies in its present form, except for

necessitous children, i.e. children who would not otherwise get any meal at all in the middle of the day. For the rest, by nutritional standards even the best meals provided are not so much better than those supplied in the children's own home as to justify the expenditure and effort involved.

58. On the other hand, when school meals can be established on a sound basis, I consider that they should be provided not only for necessitous children but for every school child, thus avoiding the undesirable element of charity and discrimination with which we have had to deal in school feeding in the United Kingdom, and which, once associated in people's minds with the idea of school meals, is very hard to eradicate.

59. In the meantime, the Barbados "mid-morning snack" is an attempt to improve the nutrition of school children which has certain merits. It consists of one third of a pint of milk and two biscuits given at about 10.30 a.m. In the first place, it supplies milk solids carrying the B2 vitamins in which, as I have shown, the typical West Indian diet is deficient, together with some protein of good quality and calcium. Secondly, the biscuits provide a readily available source of energy at a time of day when the level of the blood sugar will be particularly low if, as is generally the case, the child's morning meal was taken some three or four hours earlier and comprised at the best a bowl of thin gruel or pap, a "bake" and a mug of bush tea. Thirdly, unlike the usual school meal, the snack provides a supplement in a form easy to handle, and fourthly, it is applied universally without discrimination of class or wealth.

Plan for Building a Long-Term Programme Using the School Meals Service as a Starting Point.

60. It is recommended that long-term plans for the improvement of nutrition be built up on the experience which can be gained in putting school meals on to a satisfactory footing. The various problems can be worked out in relation first to this convenient and accessible section of the population, as a step towards applying the results on a territorial scale. Such a recommendation may appear to ignore the present adult generation, but, in my opinion, more may be achieved through the children than by a direct approach to the adults.

It is also to be hoped that this procedure will provide a foundation for a revision of large-scale catering techniques generally, in the direction of making full use of modern knowledge of food technology in relation to the nutritional value of food.

61. The work to be done falls under the following heads:—

(a) To organise production in such a way as to get the right sort of crops at the right time of year for maximum production, and in the right proportions to meet the dietary requirements of the schools concerned;

(b) To arrange for processing of these foods so that they can be stored for use all the year round. This will need planning from the point of view both of dietetics and nutritional value, and if skilfully done, it should result in supplies reaching the schools in a form which will greatly reduce the burden imposed on the teachers by school meals as at present organised;

(c) To study the best way to establish the use of these food products, what modifications may be necessary to meet firmly rooted food habits and how new habits may best be inculcated, and to organise distribution to, and the handling of food in, the schools.

(d) To assess the state of nutrition before the work starts and again after the scheme has been in progress for some time, i.e. to determine the value of the meals in terms of improvement in health.

62. The various aspects of the problem should be worked out and integrated in a field experiment to be carried out by a Nutrition Working Party. It is recommended that this should be done with, for the most part, staff who will subsequently be part of the normal personnel of the territory in which the Working Party is sited, reinforced where necessary with technical experts from outside. The personnel required will include a medical officer with a knowledge of nutrition and experience of health work in schools, an agronomist, a food technologist, and a nutritionist* who will plan how best to make use of the processed products in school menus and, in association with a welfare worker, study food habits and attitudes in the population generally in relation to this system.

63. A suitable location for the Working Party would, I suggest, be on part of a site in the Caroni area in Trinidad which is later to be developed as a Teachers' Training Institute and a Farmers' Institute, and on part of which, also, the Department of Agriculture is setting up an experimental station. The value of linking up this work with that already planned for this site, as well as of facilitating collaboration with the Imperial College of Tropical Agriculture, hardly needs emphasis.

Food Supplies for School Meals.

64. It is not suggested that all the foods used for the school meals should be locally produced. The most advantageous combination of home produce and imported foodstuffs is precisely what the Working Party has to find out and apply in this field experiment no less than later, when the time comes to consider its application on a territorial scale. A good deal of the economics involved can already be worked out without any experiment at all, e.g. what an acre of sugarcane will buy in terms of rice, etc. The cropping programme may be expected to relate principally to perishable foods and foods whose local production is likely to be an economic proposition. Some data for Trinidad are already available in Professor Paterson's report (8), which shows that, on the assumption that the money equivalent of land and labour is a valid basis of comparison, the crops giving good returns are sugarcane and yams, while mung beans (woolly pyrol) and rice would be produced at a loss.

65. Experiments are needed to determine the varieties to grow to get the best resistance, yields, nutritional value, and quality as judged by ordinary commercial standards, and again to work out what cropping programme, in relation to growing seasons, will give maximum returns for land and labour expended. The effectiveness of partial shade and other devices for protection, as aids to out of season cultivation in Trinidad, should be examined from the point of view of the Working Party's objectives. Fertilisers required for soil nutrition will also have to be taken into consideration.

Food Technology.

66. In temperate climates the commonest methods of preserving foods are refrigeration and possibly canning. These will probably prove too costly as the principal techniques for the markets of the tropical areas, for which some form of drying is more likely to be adopted. I submit that the new technique of drying in edible oil under vacuum will give a product superior both aesthetically and nutritionally, and at substantially less cost, than air-drying, and that it may be expected to become the foundation of a great deal of the technology of tropical foods. This does not, of course, exclude fermentation, † canning, bottling, preserving with salt and sugar and vinegar, all of which may have their place.

* This is a clumsy word, but it is felt that "nutrition expert" should be reserved for experts at the highest level, while the connotation of "dietitian" is too narrow.

† For the importance of fermentation in human nutrition, see (9).

67. The food technologist and agronomist in the Working Party will have to organise production and preliminary preparation before processing, in such a way as to utilise the plant to capacity for as large a part of the year as possible. The use of itinerant processing units, to process at the site of production, should also be tried, provided the necessary labour can be arranged to clean and prepare the raw materials.

68. It is suggested that the technological side of the Working Party might well develop into a food technology department associated with the Imperial College of Tropical Agriculture, working on a much broader basis than the present Low Temperature Research Station there. There is scope for work not only on the lines indicated above, but also on the application of recently acquired knowledge to the storage of products which do not require special drying techniques, such as grains and pulses.

Nutritionist.

69. The nutritionist has the task of bridging the gap between the food technologist and the consumer—that is, in the first place, the schools. This entails blending and processing in such a way that the products can be reconstituted as one or two simple or composite dishes in a variety of meals, attention being given to appearance, flavour, ease of reconstitution and food value. Plans have to be worked out for distribution, suitable menus, and the equipment and personnel required for reconstituting and serving the material in the school kitchen. The study of food habits will also fall to this member of the Party, in close association with a welfare worker.

Welfare Worker.

70. The welfare worker, with knowledge of the local sociological background and the social factors contributing to malnutrition, will help in the approach to the consumer, advise on food habits and preferences and the best ways of presenting the new products, and elucidate the reasons for any objections and difficulties which may be met with in this part of the work.

Medical Officer.

71. The Medical Officer's function in the team is two-fold. It consists, in the first place, in keeping watch on results in terms of improved health, by assessing the state of nutrition of the children beforehand and again when improved feeding has been in progress for some time. After the first examination, it should be possible to estimate the benefits which may be expected to follow from giving a well planned meal, especially if the principle of the Oslo Breakfast is adopted, i.e. that of administering the majority of the important nutrients to the children in the one meal. Secondly, ability to interpret the state of health in terms of the insufficiency of certain dietary factors will be useful in educating the community, and will provide arguments which may carry weight with both children and parents.

Wider Educational Aspect.

72. Out of the groundwork done by the Working Party, the educational authorities should be able to evolve a co-ordinated curriculum for teachers in training and pupils in schools, showing how the economics of production, and the agricultural, domestic and nutritional aspects of the plan, are all integrated in the school feeding system. The teaching can be replicated in the school garden and the domestic science kitchen in feeding the younger children of nursery school age. This, in view of the weakness of the home as a unit in West Indian society, is an important feature because it stresses proper home management.

Wider Application of the Scheme.

73. When the practical difficulties in operating the scheme have been solved, it is reasonable to expect the principle of the plan to be applied to the food supply of the population as a whole. With this end in view, the Nutrition Committee should consider ways and means of gaining the interest and goodwill of local organisations, and possibly extending the Working Party's results to a single organised village community in the first place. The co-operation of any such body as a progressive village council would obviously be extremely valuable, and the possibilities of developing village fairs as social and educational rallying points might be examined.

74. The data and experience of the Working Party may be expected to throw light on some of the vexed problems arising in the organisation of land settlements, e.g. size of holding, crops to be grown, techniques for handling gluts whereby surpluses can be put by for lean periods. It is also very probable that data obtained in the course of this work will help to decide whether the security and stability so necessary to a community could be built up more easily by small holdings or on a collective basis on bigger holdings, to compete with countries where farming is carried on on a large scale.

75. The progress of the Working Party is likely to be watched with interest by other territories in the area, in some of which great interest was shown in the idea when I discussed it in the later part of my tour. In these, the intention was expressed of forming teams to work on similar lines, and neighbouring Governments would therefore probably wish to send selected officers to visit the first Working Party in its later stages, to see the scheme in operation. From this the practice might develop of holding a conference, say triennially, of nutrition workers from the various territories, to discuss their problems and techniques and to pool their experience.

The maintenance of close liaison with the central colonial nutrition organisation, as it develops, is also recommended.

76. Finally, it is probable that the principles underlying this approach to the improvement of nutrition will be of interest also to territories in other parts of the world, where its adaptation to meet other conditions may be considered later.

9th October, 1945.

B. S. PLATT.

SUMMARY OF MAIN RECOMMENDATIONS

Immediate

Use of flour of improved nutritional quality, paras. 24-29.

Increased consumption of skimmed milk powder, pulses and groundnuts, and green leafy vegetables, paras. 32-37.

Parboiling of rice, para. 38.

Improvement of cooking methods, para. 45.

Measures for ensuring equitability of distribution and provision for priority groups, paras. 46-47.

Long-term programme

Nutrition Working Party to work out a long term programme, including the application of a new processing technique to the problem of spreading supplies through the year, using school meals as a starting point for the approach to the consumer, paras. 54-71.

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APPENDIX I

ITINERARY OF VISIT

The itinerary of my visit is briefly summarised below.

1944.			
November	4th,	7 a.m.	Left Miami for Trinidad, via Puerto Rico. Arrived 6 p.m. Stayed Trinidad until 11th.
"	11th	... ..	Left Trinidad for British Guiana. Stayed British Guiana until 20th.
"	26th,	11 a.m.	Left British Guiana for Trinidad. Arrived 4.30 p.m. Stayed Trinidad until 3rd December.
December	3rd,	11 a.m.	Left Trinidad, arrived Barbados 4 p.m. Stayed Barbados until 11th December.
"	11th	... ..	Barbados to Antigua by air. Antigua to St. Kitts (one day). Stayed St. Kitts until 19th.
"	19th	... ..	Left St. Kitts for Barbados. Stayed Barbados until 25th.
"	25th	... ..	Left Barbados for Trinidad.
"	26th	... ..	Left Trinidad for Puerto Rico. Stayed Puerto Rico until 1st January.
1945.			
January	1st	... ..	Left Puerto Rico for Jamaica. Stayed Jamaica until 10th.
"	10th	... ..	Left Jamaica for Miami, arriving 8.30 p.m. 11.45 p.m. Left Miami, arriving New York 9 a.m., 11th.

In each of the territories visited I examined samples of school children from typical areas, and a few adults, and gave clinical demonstrations. Agricultural Officers as well as Medical Officers often visited the schools with me, and, conversely, Medical Officers accompanied me on expeditions to study the agricultural aspect of the problem. Its sociological and educational aspects also received attention, and administrative personnel usually took part in all these activities with me. I had also numerous opportunities for discussion with members of the public in many walks of life.

One of my visits to Trinidad happened to coincide with the inter-territorial conference on venereal disease, and this gave me an opportunity for meeting medical men from all parts of the British West Indies. One morning was spent in discussing principles with them, and another in demonstration.

APPENDIX II

EXTRACT FROM THE PROCEEDINGS OF THE NUTRITION SOCIETY*

The following extract is taken from the record of a discussion on *Nutritional Factors Affecting Wound Healing* at a meeting of the Nutrition Society held on 26th May, 1945.

" Dr. Platt showed several slides of:—

" (1) The legs of Chinese apprentices in Shanghai factories, in which ulcers were seen developing in skins showing evidence of malnutrition. He explained that in addition to malnutrition, two other groups of factors were involved, (a) trauma and (b) infection. In the examples shown it was probable that the lesion began as a result of bed bug bites on poorly nourished skins and that the bites became infected.

" (2) The nature of the malnutrition present in the skins in which these chronic ulcers develop. Dr. Platt showed pictures of what he called "crackled skin", an appearance similar to that seen in mild pellagra. It had been thought that this type of skin was associated with insufficiency of vitamin B₂ factors in the diet. He pointed out, however, that in the earlier work on the biological value of proteins, false values had been obtained probably because the proteins were impure and were mixed with B₂ vitamins. He thought it likely that at the present time there might be confusion between the clinical evidence of B₂ deficiency and of insufficiency of certain essential amino acids. Some data he had obtained in three different parts of the world suggested that the underlying malnutrition in chronic ulcer of the skin of the legs might prove to be insufficiency of certain amino acids.

The following table was shown.

* Not yet published.

	NEWFOUNDLAND	W. INDIES (Barbados)	W. AFRICA (Gambia)
<i>Population sample</i>	868 <i>mixed ages and sexes</i>	192 <i>school-children both sexes</i>	50 <i>school-children both sexes</i>
Ulcers and ulcer scars on legs	rare	common 30 per cent.	common 56 per cent.
Dry skin	rare 3 per cent.	common over 50 per cent.	common 54 per cent.
Crackled skin of legs ...	rare	fairly common 14 per cent.	common 54 per cent.
Evidences of deficiency of B ₂ group	common	fairly common	rare
Evidences of C deficiency <i>Nutrient levels</i>	common	none	none
Protein	high mixed 88.4 g.	low 42 g.	probably low, mainly plant origin
Riboflavin	1 mg.	0.75 mg.	no quantitative data (a)
Nicotinic acid	15 mg.	7 mg.	do. (b)
Ascorbic acid	48 mg.	69 mg.	do.

(a) Probably better than Barbados in view of amounts of fermented foods eaten (9).

(b) Probably satisfactory, partly for same reason as (a) and partly because of consumption of groundnuts.

It was pointed out that this table suggested that the incidence of ulcers might not be related to the intake of B₂ vitamins, but it did appear to be associated with the level of protein intake. Some estimations already made of the methionine content of West Indian diets indicated a methionine content of about one quarter of that of a European diet."

APPENDIX III

VALUES FOR NUTRIENTS RECOMMENDED AS AN IMMEDIATE OBJECTIVE

The values adopted in this report are given on a *per head basis for a population of mixed age and sex groups* and are as follows:—

Calories	2,500
Protein	60 g.
Calcium	800 mg.
Iron	20 mg.
Vitamin A (as β carotene)	5,000 I.U.
Aneurin, thiamine (vitamin B ₁)	1.5 mg.
Riboflavin	1.8 mg.
Nicotinic acid	12 mg.
Ascorbic acid (vitamin C)	30 mg.

Calories.—It has been assumed that in the West Indies the body weight of the "average person" is about 60 kg. The "average person" is a device used to allow recommendations to be made on a per head basis and takes into account the age and sex distribution of men, women and children in the population. Comparable figures worked out on the populations of the United States and United Kingdom are 2,531 and 2,546 respectively (10).

Protein.—The protein figure of 60 g. per head per day represents an allowance of 1 g per Kg. of body weight. Requirements for maintenance may be as low as 35 g., but on account of the greater needs of the children to meet their growth requirements, it is considered that 1 g. per Kg. body weight is the best average figure to adopt.

Calcium.—The calcium allowance of 800 mg. may be higher than necessary for territories where the amount of sunshine contributes to good utilisation. In this connection, however, it is important to stress that, unless supplies of vitamin A are plentiful, the skin will not be kept in sufficiently good condition to exercise its function in the formation of vitamin D on exposure to sunlight.

Iron.—The iron allowance has deliberately been placed higher than usual. The Type Dietary works out at 16 mg. and would normally be considered adequate, but under conditions of a high incidence of infestation with parasites, especially hookworm and malaria, with consequent anaemia, it is necessary to raise the allowance.

Vitamin A.—The vitamin A allowance has been placed at 5,000 I.U. on the assumption that it will be supplied almost entirely in the form of precursors. The conclusion reached in a recent experiment undertaken by the Vitamin A Sub-Committee of the Accessory Food Factors Committee (Medical Research Council and Lister Institute) is that "inclusion in the diet of a daily dose of 2,500 I.U. vitamin A, or of 5,000 I.U. carotene, may be regarded as adequate for maintenance of normal human adults and as leaving a fair margin of safety." (11).

Aneurin, thiamine.—The important factor is the ratio of vitamin B₁ to energy (calories) derived from carbohydrates and protein (sometimes called non-fat calories). Various values have been given to the vitamin/non-fat calorie ratio, ranging from 0.19 mg. to 0.6 mg. per 1,000 non-fat Calories (12) (13). It will be seen that the value taken here is based on the highest ratio.

Riboflavin.—The value adopted by the Accessory Food Factors Committee (Medical Research Council and Lister Institute) has been taken.

Nicotinic acid.—From the same authority as riboflavin.

Ascorbic acid.—In this case the League of Nations' recommendation has been followed. (14).

APPENDIX IV DISTRIBUTION OF NUTRIENTS IN THE DIETARIES

FOOD CATEGORY	BARBADOS	JAMAICA	TRINIDAD	ENNOBLED TYPE DIETARY (a)	
				A	B
<i>Calories</i>					
Cereals... ..	835	384	1,213	791	1,182
Starchy roots and fruits	597	1,092	290	689	392
Pulses and nuts	23	113	54	103	103
Animal products	349	129	286	184	184
Fats and oils	194	123	328	513	385
Vegetables and fruits	9	41	43	52	52
Sugar, etc.	406	202	365	228	228
Miscellaneous	—	8	3	—	—
TOTAL	2,413	2,092	2,582	2,560	2,526
<i>Protein (g)</i>					
Cereals... ..	23.6	13.2	37.4	25.3(b)	41.3(b)
Starchy roots and fruits	9.8	15.0	4.0	13.2	7.4
Pulses and nuts	1.8	5.6	4.5	6.2	6.2
Animal products	9.3	8.9	17.3	8.8	8.8
Vegetables and fruits	0.5	1.8	1.5	4.3	4.3
Miscellaneous	—	0.7	1.0	—	—
TOTAL	45.0	45.2	65.7	57.8	68.0
<i>Calcium (mg.)</i>					
Cereals... ..	32	13	39	172(c)	335(c)
Starchy roots and fruits	90	139	43	82	48
Pulses and nuts	6	35	21	33	33
Animal products	112	81	136	76	76
Vegetables and fruits	12	49	42	189	189
Miscellaneous	2	1	25	—	—
TOTAL	254	318	306	552	681

(a) Flour ennobled with 2 per cent. food yeast and 0.5 per cent. bone meal. No supplementary iron, *see text*, para. 31.

(b) Including yeast protein.

(c) With calcium carbonate at rate recommended in place of bone meal, values would be 156 and 314 respectively.

DISTRIBUTION OF NUTRIENTS IN THE DIETARIES—(contd.)

FOOD CATEGORY	BARBADOS	JAMAICA	TRINIDAD	ENNOBLED TYPE DIETARY (a)	
				A	B
<i>Iron (mg.)</i>					
Cereals... ..	5.2	2.7	6.8	5.6	8.9
Starchy roots and fruits ...	5.1	8.9	1.4	7.0	3.9
Pulses and nuts	0.3	1.0	0.6	1.0	1.0
Animal products	1.0	1.3	2.3	1.5	1.5
Vegetables and fruits ...	0.2	0.8	1.2	2.8	2.8
Miscellaneous	—	0.3	0.5	—	—
TOTAL	11.8	15.0	12.8	17.9	18.1
<i>Vitamin A (I.U.)</i>					
Cereals... ..	24(b)	15(b)	18(b)	28(b)	28(b)
Starchy roots and fruits ...	4,252(b)	11,837(b)	2,591(b)	6,788(b)	4,525(b)
Animal products	138	119	189	63	63
Fats and oils	70	23	165	(c)	(c)
Vegetables and fruits ...	731(b)	665(b)	1,600(b)	11,455(b)	11,455(b)
Miscellaneous	—	3	16	—	—
TOTAL	5,215	12,662	4,579	18,334	16,071
<i>Aneurin (mg.)</i>					
Cereals... ..	0.26	0.11	0.45	0.54	0.81
Starchy roots and fruits ...	0.35	0.53	0.17	0.45	0.26
Pulses and nuts	0.03	0.11	0.12	0.15	0.15
Animal products	0.12	0.08	0.11	0.05	0.05
Vegetables and fruits ...	0.02	0.10	0.07	0.15	0.15
Miscellaneous	—	0.01	0.06	—	—
TOTAL	0.78	0.94	0.98	1.34	1.42
<i>Riboflavin (mg.)</i>					
Cereals... ..	0.18	0.08	0.29	0.35	0.58
Starchy roots and fruits ...	0.35	0.67	0.17	0.40	0.22
Pulses and nuts	0.01	0.08	0.03	0.08	0.08
Animal products	0.22	0.18	0.36	0.16	0.16
Vegetables and fruits ...	0.01	0.10	0.04	0.25	0.25
Miscellaneous	—	0.02	—	—	—
TOTAL	0.77	1.13	0.89	1.24	1.29
<i>Nicotinic Acid (mg.)</i>					
Cereals... ..	2.21	1.04	7.00	5.89	7.93
Starchy roots and fruits ...	3.19	5.52	1.40	3.12	1.82
Pulses and nuts	0.24	0.59	0.35	1.70	1.70
Animal products	1.14	1.60	3.00	1.29	1.29
Vegetables and fruits ...	0.19	0.49	0.35	0.95	0.95
Miscellaneous	—	0.09	0.01	—	—
TOTAL	6.97	9.33	12.11	12.95	13.69
<i>Ascorbic Acid (mg.)</i>					
Starchy roots and fruits ...	62	117	35	34	22
Vegetables and fruits ...	6	42	44	96	96
Miscellaneous	1	1	—	1	1
TOTAL	69	160	79	131	119

(a) Flour ennobled with 2 per cent. food yeast and 0.5 per cent. bone meal. No supplementary iron, see text, para. 31.

(b) As carotene.

(c) Would contribute in so far as butter, fortified margarine, or other fat or oil containing vitamin A or its precursors formed part of the allowance.

APPENDIX V

NOTE ON NATIONAL MILK COCOA

1. Experiments carried out by the Ministry of Food have shown that spray dried skimmed milk powder (when obtainable) is preferable to roller dried milk, as the latter forms a heavy precipitate in the drink. The dry ingredients should be mechanically mixed, either in quantities as required for immediate use or for storage in moisture proof containers in a *cool, dry place, for not more than two months*. If the powder is kept too long or allowed to become damp, off flavours are developed and it is difficult to reconstitute.

Dried skimmed milk powder	...	...	...	...	70 parts by weight
Cocoa powder	...	...	...	...	14 " " "
Sugar	...	...	...	...	16 " " "
Saccharin if desired.					

 100

2. *To make 1 gallon of cocoa (24 cups)*

Measure $1\frac{1}{2}$ pints of luke-warm water into a bowl.

Weigh out $1\frac{1}{2}$ lbs. milk cocoa mixture.

Add the powder to the water *gradually*, whisking and stirring all the time.

Pour this mixture into a saucepan containing 6 pints of boiling water, stir until well mixed and serve *piping hot*.

3. *To make 1 cup of cocoa*

Put 2 level tablespoons of the powder in each cup and mix to a smooth cream with water.

Add enough boiling water to make $\frac{1}{2}$ pint, stir well until mixed and serve *piping hot*.

4. *To make 4 gallons (100 cups)*

$\frac{3}{4}$ gallon luke-warm water in mixing bowl.

$5\frac{1}{2}$ lbs. milk cocoa powder, added gradually, mix with balloon whisk or in machine.

Pour into urn containing 3 gallons boiling water, whisking all the time.

APPENDIX VI

VALUES(a) PER 100 g. EDIBLE PORTION OF CERTAIN FOODSTUFFS

FOODSTUFF	WATER g.	CALS.	PRO. g.	CALCIUM mg.	IRON mg.	VITAMIN A I.U.(b)	ANEURIN mg.	RIBO- FLAVIN mg.	NICOTINIC ACID mg.	ASCORBIC ACID mg.
<i>Fish :—</i>										
Cod, salt, wet... ..	55	93	22	35	1.5	Ø	0.05	0.36	5	Ø
Salt, hard, dry	40	182	42	65	2.5	Ø	0.06	0.31	4.6	Ø
White, sea, fresh fillet	80	73	16	20	0.7	Ø	0.05	0.13	3	Ø
Food yeast	8	206	43.1	127	20	0	2	6	30-40	0
<i>Leaves :—</i>										
Dark green	85	44	4	210	3	13,000-C	0.15	0.25	0.85	100
Pale green	90	26	3	85	1	500-C	0.10	0.10	0.35	50
<i>Legumes :—</i>										
Cowpea	10	281	24	90	4	50-C	0.89	0.14	1.3	0
Groundnut	6	555	23	50	2	Ø	0.90	0.14	17.4	0
Kidney bean	10	306	24	110	8	0	0.45	0.34	2.3	0
Pea, garden or field	10	309	22	60	4	200-C	0.45	0.18	2.8	0
Pigeon pea	10	306	22	140	4	(o)	0.45	(0.34)	(2.3)	0
Soya bean	7	382	35	220	7	(c)	1.12	0.32	2.1	Ø
<i>Meat :—</i>										
Beef, fresh, lean carcase	66	189	18	12	4	(40)	0.09	0.25	5	Ø
Pork, salt, fat... ..	—	781	4	2	0.6	—	(0.04)	0.06	(0)	0
<i>Milk :—</i>										
Skimmed, powder	5	360	35.6	1,240	2	60	0.39	1.60	1.1	7
Whole, condensed, sweetened	28	314	8.2	290	0.4	400	0.10	0.36	0.2	1
Whole, fresh (2.5 per cent. fat)	89	53	3	120	0.2	100	0.04	0.15	0.1	1
<i>Rice :—</i>										
Milled, raw	12	349	7	5	0.5	0	0.06	0.05	1	0
Milled parboiled	12	352	7.5	8	1	Ø	0.21	0.10	4	0

<i>Starchy roots and fruits :—</i>										
Arrowroot	15	337	0·2	7	1	0	0	(0)	(0)	0
Banana and plantain	70	103	1	7	0·5	(d)	0·05	0·06	0·5	10
Cassava, fresh	60	131	0·7	25	1	0	0·02	0·10	—	30
Sweet potato	70	121	2	20	0·7	(e)	0·10	0·06	0·7	20
Taro, dasheen, eddo, tannia	75	88	2	25	1	40-C	(0·05)	(0·06)	0·4	20
Yam	73	100	2	10	1·2	—	0·05	0·06	(0·4)	(15)
<i>Wheat flour (Manitoba) :—</i>										
70 per cent. extraction ...	13	351	13	13	2·3	0	0·07	0·07	0·86	0
80 per cent. extraction ...	13	349	13·6	16	2·6	∅	0·20	0·08	1·13	0

∅ = negligible.

Figures in brackets indicate tentative or provisional values.

- (a) All values except those for wheat flour taken from (5).
 (b) "C" = "as carotene".
 (c) 0-400 I.U. (carotene) depending on variety.
 (d) Banana 350 I.U. (carotene); Plantain 100 I.U. (carotene).
 (e) White varieties, ∅; Yellow varieties, 4,000-7,000 I.U. (carotene).

TABLE I

ESTIMATED FOOD SUPPLIES FOR BARBADOS, JAMAICA AND TRINIDAD FOR YEARS SHOWN

(Gross weights)

FOODSTUFF	UNIT	BARBADOS 1944	JAMAICA 1942	TRINIDAD(a) 1944
CEREALS :—				
Biscuits	long tons	1,724		
Maize and cornmeal	" "	3,413	6,340	3,570
Miscellaneous	" "			892
Rice	" "	4,880	3,880	23,800
Wheat flour	" "	6,825	38,400	40,200
STARCHY ROOTS AND FRUITS :—				
Bananas	" "	2,455	145,000	29,900
Cassava	" "	5,000		8,020
Eddoes	" "	4,200		10,700
English potatoes... ..	" "			3,120
Ground provisions unspecified... ..	" "		413,314	
Sweet potatoes	" "	17,527		13,950
Yams	" "	18,409		4,650
PULSES AND NUTS :—(b)				
Groundnuts	" "	70		
Peas and beans	" "	448	10,580	3,570
ANIMAL PRODUCTS :—				
<i>Fish :—</i>				
Alewives	" "		800	
Canned fish	" "		470	1,340
Dried	" "	780	2,850	2,680
Fresh	" "		1,785	3,350
Pickled	" "		2,664	
<i>Meat :—</i>				
Bacon and ham	" "	220	125	1,160
Beef, fresh and pickled... ..	" "	480		5,120
Canned meat	" "	256	248	1,022
Dried meat	" "			63
Pork, fresh and pickled... ..	" "	480		
Pork, unspecified	" "		11,806	2,670
Poultry	" "	28		429
Salted meat	" "	1,950	971	
<i>Milk :—</i>				
Condensed, whole, sweetened	" "	269	1,930	4,063
Dried, whole	" "			241
Evaporated, whole	" "			527
Fresh, whole	galls.	1,500,000	4,396,370	500,000
Cheese	long tons			250
Eggs	dozen	83,300	1,452,428	698
				(tons)
FATS AND OILS :—				
Butter and butter substitute	long tons	186	372	1,160
Coconut oil, raw	" "		7,250	
Coconuts	" "			
Edible oils	" "	299,000 (galls.)	4,460	4,880
Lard compound	" "		622	1,075
Margarine... ..	" "	195	819	48

(a) For purposes of comparison figures have been converted from short to long tons,

(b) Except coconuts, which see under Fats and Oils.

FOODSTUFF	UNIT	BARBADOS 1944	JAMAICA 1942	TRINIDAD(a) 1944
VEGETABLES AND FRUIT(b) :—				
Canned vegetables	long tons			152
Corn	" "	1,500		
Fresh vegetables... ..	" "	556	29,286	16,070
Fruits, citrus	" "		8,950	
" other	" "		26,850	
" unspecified	" "			(8,000) ?
Garlic and onions	" "			626
SUGAR, ETC. :—				
Honey	" "		550	
Sugar, refined	" "		16,750	
" unspecified	" "	7,280		17,810
" wet and confectionery	" "		7,041	
YEAST				
	" "		64	
BEVERAGES :—				
Beer	galls.	32,014	311,388	
Cocoa	long tons	46	893	892
Coffee	" "	110	893	223
Rum	galls.	235,000	598,812 (pr.g.)	
Tea	long tons	28	34	174
CONDIMENTS :—				
Mustard, etc.	" "			45
Pickles in vinegar	galls.			38,000
Salt	long tons	1,716	10,320	2,778

(a) For purposes of comparison figures have been converted from short to long tons.

(b) Other than starchy roots and fruits.

TABLE II
SUMMARY OF FOOD CONSUMPTION

(ozs. per head per day, edible portion)

FOOD CATEGORY	BARBADOS 1944 (Popn. 200,000)	JAMAICA 1942 (Popn. 1,237,063)	TRINIDAD 1944 (Popn. 540,000)
Cereals	8.3	3.9	12.4
Starchy roots and fruits...	19.2	35.2	9.8
Pulses and nuts	0.25	0.8	0.6
Animal products (a)	1.9	1.3	2.6
Milk in various forms	2.9 (b)	1.8 (c)	1.3 (d)
Fats and oils	0.8	0.6	1.4
Vegetables and fruits (e)	0.5	4.4	3.4
Sugar, etc.	3.6	1.9	3.2

(a) Except milk and fats.

(b) Including 2.7 ozs. fresh milk.

(c) " 1.6 " " "

(d) " 0.75 ozs. sweetened condensed milk. The figure is therefore not directly comparable with the others.

(e) Other than starchy roots and fruits.

TABLE III
CHANGES IN RICE AND FLOUR IMPORTS

FOOD AND YEAR	BARBADOS (d)		JAMAICA (d)		TRINIDAD (d)	
	long tons	ozs. head/day	long tons	ozs. head/day	long tons	ozs. head/day
Rice—						
1937 (a)	9,306	4·8	17,434	1·5	18,542	4·4
1944 (b)	4,886	2·4	3,880	0·3	14,820 (c)	2·7 (c)
Flour—						
1937 (a)	7,058	3·6	32,120	2·7	29,860	7·1
1944 (b)	6,825	3·4	38,400	3·1	40,200	7·3

(a) From *An Economic Survey of the Colonial Empire* (1937), Colonial No. 179, 1940.

(b) Except Jamaica, 1942.

(c) With local production of 8,930 long tons, consumption=4·3 ozs. per head per day.

(d) Population figures taken as follows:—

		1937 (a)	1944 (b)
Barbados	...	191,000	200,000
Jamaica	...	1,153,000	1,237,000
Trinidad	...	413,783	540,000

TABLE IV

EVALUATION OF DIETARIES OF BARBADOS, JAMAICA AND TRINIDAD

NUTRIENT	UNIT	BARBADOS 1944	JAMAICA 1942	TRINIDAD 1944	IMMEDIATE OBJECTIVE
Calories	—	2,413	2,092 (a)	2,582	2,500
Protein	g.	45	45	66	60
Fat	"	63	32	63	—
Carbohydrate	"	416	406	442	—
Calcium	mg.	254	318	306	800
Iron	"	12	15	13	20
Vitamin A	I.U.	5,215 (b)	12,662 (c)	4,579 (d)	5,000
Aneurin (vitamin B ₁)	mg.	0·78	0·94	0·98	1·5
Riboflavin } vitamin	"	0·77	1·13	0·89	1·8
Nicotinic acid } B ₃ complex	"	6·97	9·33	12·11	12
Ascorbic acid (vitamin C)...	"	69	160	79	30

(a) Probably indicates a less complete return rather than an average energy intake substantially lower than the others. This would, of course, affect all nutrient values but in unknown degrees.

(b) 208 I.U. as vitamin A, rest as carotene.

(c) 142 " " " " " "

(d) 299 " " " " " "

TABLE V
TYPE DIETARIES
(ozs. per head per day)

FOOD CATEGORY	TYPE A (LOW FLOUR)	TYPE B (HIGH FLOUR)
Cereals	8 (a)	12 (b)
Starchy roots and fruits	23 (c)	13 (d)
Pulses and nuts (e)	1	1
Animal products (f)	1.5	1.5
Milk (g)	2	2
Fats and oils	2	1.5
Vegetables and fruits (h)	5	5
Sugar	2	2

(a) Taken as 4 ozs. flour, 3 ozs. rice, 1 oz. maize meal.

(b) " " 8 " " " " " " " " " "

(c) " " including 6 ozs. (Yellow) sweet potatoes.

(d) " " " 4 " " " " " " " "

(e) " " $\frac{3}{4}$ oz. pigeon peas, $\frac{1}{4}$ oz. groundnuts.

(f) Excluding milk and fats. Taken as $\frac{1}{2}$ oz. beef, $\frac{1}{2}$ oz. salt fat pork, $\frac{1}{4}$ oz. dried fish, $\frac{1}{4}$ oz. fresh fish.

(g) Whole fresh milk or equivalent.

(h) Taken as 3 ozs. green leaves, 1 oz. citrus and tomato, 1 oz. miscellaneous vegetables.

TABLE VI
EVALUATION OF TYPE DIETARIES
A.—USING WHITE FLOUR (70 PER CENT.) (a)

NUTRIENT	UNIT	TYPE A	TYPE B	IMMEDIATE OBJECTIVE
Calories	—	2,560	2,532	2,500
Protein	g.	56	65	60
Fat	"	81	68	—
Carbohydrate	"	402	416	—
Calcium	mg.	403	384	800
Iron	"	16	16	20
Vitamin A (b)	I.U.	18,334 (c)	16,071 (c)	5,000
Aneurin (vitamin B ₁)	mg.	1.01	0.90	1.5
Riboflavin } (vitamin B ₂ complex)	"	1.05	0.95	1.8
Nicotinic acid } (vitamin B ₃ complex)	"	9.31	8.98	12
Ascorbic acid (vitamin C)	"	131	119	30

(a) And "white" (i.e., raw, milled) rice. Use of parboiled milled rice would give the following totals for B vitamins:—

	Type A	Type B
Aneurin	1.14	1.03
Riboflavin	1.09	0.99
Nicotinic acid	11.87	11.54

(b) Values would be higher in so far as butter, fortified margarine or other fat containing vitamin A or its precursors formed part of the diet.

(c) 63 I.U. as vitamin A, the rest as carotene.

TABLE VI—(contd.)

EVALUATION OF TYPE DIETARIES

B.—USING ENNOBLED (a) LONG EXTRACTION FLOUR (80 PER CENT.) (b)

NUTRIENT	UNIT	TYPE A		TYPE B	
		2 per cent. food yeast	3 per cent. food yeast	2 per cent. food yeast	3 per cent. food yeast
Calories	—	2,560	2,556	2,526	2,519
Protein	g.	58	58	68	69
Fat	"	82	82	69	69
Carbohydrate	"	396	397	409	407
Calcium	mg.	552 (c)	553 (c)	681 (c)	683 (c)
Iron	"	17.9	18.1	18.1	18.5
Vitamin A (d)	I.U.	18,334 (e)	18,334 (e)	16,071 (e)	16,071 (e)
Aneurin	mg.	1.34	1.35	1.42	1.44
Riboflavin	"	1.24	1.31	1.29	1.42
Nicotinic acid	"	12.95	13.31	13.69	14.41
Ascorbic acid	"	131	131	119	119

(a) Food yeast as shown, 0.5 per cent. bone meal, reduced iron if required to bring total up to minimum of 13 mg. per lb. (No supplementary iron needed here, see para. 31.)

(b) And parboiled, milled rice.

(c) If calcium carbonate at the rate of 1.4 g. per lb. replaces bone meal, the values for calcium would read, 536, 537, 660, and 662.

(d) and (e) as (b) and (c) respectively in Part A of table.

TABLE VII

ESTIMATED RELATIVE COST IN JAMAICA OF SUPPLYING RIBOFLAVIN AND NICOTINIC ACID FROM VARIOUS SOURCES

SOURCE	MG. PER LB.		ESTIMATED RELATIVE PRICE PER MG. (FOOD YEAST=1)	
	RIBOFLAVIN	NICOTINIC ACID	RIBOFLAVIN	NICOTINIC ACID
Food yeast	23	180-205	1	1
Skimmed milk powder	9	5	7	100-110
Pulses	0.6-1.5	6-18	15-40	10-38
Groundnuts	0.6	79	No price data	
Fresh milk (a)	0.7	0.5	13	140-160
" beef (a)	1	23	32	11-12
" vegetables, leafy and other	0.03-0.2	0.1-0.8	55-350	100-1,000

(a) See text, para. 27.

TABLE VIII
EVALUATION OF POOR DIETARY

FOOD CATEGORY	OZS./HEAD/DAY EDIBLE PORTION	NUTRIENT	UNIT	PER HEAD PER DAY		
				POOR DIETARY	IMMEDIATE OBJECTIVE	TYPE DIETARY A FROM TABLE VI
Cereals	5 (a)	Calories	—	2,166	2,500	2,560
Starchy roots and fruits ...	32 (b)	Protein	g.	37 (e)	60	56 (f)
		Fat	"	21	—	81
Pulses and nuts	0.25	Carbohydrate	"	456	—	402
Animal products (c) ...	0.5	Calcium	mg.	183	800	403
Fats and oils	0.5	Iron	"	13	20	16
Vegetables and fruits ...	1 (d)	Vitamin A	I.U.	(g)	5,000	18,334 (h)
Sugar, etc.	4.5	Aneurin (Vitamin B ₁) ...	mg.	0.82	1.5	1.01
		Riboflavin } (Vitamin B ₂)	"	0.73	1.8	1.05
		Nicotinic Acid } complex	"	7.05	12	9.31
		Ascorbic Acid (Vitamin C) ...	"	88	30	131

(a) Taken as wheat flour (70 per cent.) 2½ ozs., rice (white) 2½ ozs., maize ½ oz.

(b) " " yams, etc., 20 ozs., sweet potatoes 12 ozs.

(c) Except milk and fats.

(d) Taken as ½ oz. citrus, ½ oz. green leafy vegetables.

(e) From cereals 14.0 g. From starchy roots and fruits 18.1 g.

(f) From cereals 23.4 g. From starchy roots and fruits 13.2 g.

(g) Very wide range depending mainly on type of sweet potato used : 1,800—25,700 I.U. All as carotene.

(h) 63 I.U. vitamin A : the rest as carotene. Would be higher in so far as fats containing vitamin A were used.

Fig. 1.

CLINICAL SURVEY OF SCHOOL CHILDREN

CLINICAL FINDINGS.		LEEWARD	BARBADOS	BRITISH	JAMAICA	TRINIDAD	PUERTO
		IS. % 195 children	% 192 children	GUIANA % 231 children	% 167 children	% 192 children	RICO % 60 children
HAIR OF HEAD. EYES.	DRY STARRING.	8.9	7.8	9.5	3.0	19.8	11.7
	HYPOCHROMOTRICHIA.	33.9	22.4	3.5	22.1	16.2	21.7
	PHOTOPHOBIA.			1.7		1.0	
	LACRIMATION.	18.0	20.3	19.5	18.6	46.5	23.3
	BLEPHARITIS.	0.5	0.5	1.7		2.1	
	PIGMENTATION.	19.5	22.9	33.8	10.2	26.6	
	HYPERAEMIA.	56.0	34.9	15.6	30.0	5.47	45.0
CONJUNCTIVAL CHANGES.	"EXCESS TISSUE" GRADE I	47.2	36.0	22.5	40.9	32.8	26.7
	"EXCESS TISSUE" GRADE II	29.8	27.1	17.8		4.7	5.0
	"EXCESS TISSUE" GRADE III	3.4	2.1	4.3	1.8	0.5	
FACE.	BITOT'S SPOTS.	(a)	(a)	0.4	(a)	0.5	(a)
	FOLLICULOSIS.	24.6	19.3	27.8	27.0	21.9	
TEETH.	DYSSEBACIA.		0.5				1.7
	MALOCCLUSION.	1.0	1.6	11.3	3.0	9.9	5.0
GUMS.	CHALKY.	40.0	28.6	23.0	22.2	23.0	31.7
	CARIES.	42.6	43.8	68.7	27.0	45.9	55.0
	ODONTOCLASIA.	8.7	(a)	(a)	5.4	10.4	3.3
	EDEMULOUS.	4.6	2.1	28.6	3.0	1.6	10.0
	RED HYPERAEMIC.			1.3	1.2	0.5	1.7
	BLUE CONGESTED.	5.7	3.1	5.2	7.2	2.1	1.7
	SWOLLEN.	5.1		12.1	2.4	4.7	5.0
TONGUE.	LOSS OF INTERDENTAL PAPILLAE.	0.5	(a)	6.5		(a)	
	RECESSION AND RETRACTION.	4.1	3.1	7.4	0.6	3.7	1.7
	BLEEDING ON PRESSURE.	8.2	1.0	7.4	3.0	7.3	5.0
	PUS ON PRESSURE.	2.6		7.4		1.6	1.7
	COLOUR CHANGES.	41.5	42.7	52.8	20.4	62.0	18.4
	HYPERTROPHIC PAPILLAE.	1.0		6.5		0.6	3.7
	PAPILLAE LOST.	8.2	6.3	17.8	16.2	4.7	18.4
LIPS.	FISSURES.	9.3	4.7	37.1	7.8	18.7	11.7
	ANGULAR STOMATITIS.	1.0				1.2	0.5
	LA PERLÈCHE.	1.0	(a)	5.5	3.6	(a)	
NAILS.	CHEILOSIS.	8.7	7.3	20.8	7.2	11.5	5.0
	DEFECTIVE.	(a)	0.5	6.5	(a)	0.5	(a)
SKIN OF BODY AND LEGS	ATROPHIC.	(a)	(a)	(a)	8.4	(a)	1.7
	XEROSIS.	52.8	51.9	15.6	42.6	18.7	48.4
	CRACKLED.	20.5	14.1	8.5	20.4	30.2	23.3
	"PERMANENT GOOSE FLESH"	3.6	6.8	5.6	7.8	5.2	3.3
	LOSS OF ELASTICITY.	63.2	53.8	36.4	60.0	33.4	35.0
	FOLLICULAR KERATOSIS.	0.5		2.6		0.5	
	HYPERKERATOSIS.	31.8	(a)	14.3	10.2	(a)	3.3
BONES.	ULCERS AND SCARS.	32.8	30.2	37.7	13.8	28.6	11.7
	DEFECTIVE HAIR.	2.6	5.7	10.8		11.5	
	SIGNS OF RICKETS.	0.5	0.5	0.9	2.4	1.0	5.0
MUSCULATURE.	POOR MUSCLE DEVELOPMENT.	25.2	6.8	13.4	9.0	11.5	25.0
	WINGED SCAPULAE.	7.2	(a)	7.4		(a)	
BLOOD.	ANAEMIA, GROSS.	5.6	7.3	(a)	1.2	18.2	

(a) Data incomplete.

Nature of Samples

Samples of the school population were taken as shown below. Each consisted of approximately 50 children and gave as far as possible a cross-section of the school or locality under examination.

Leeward Isles.—Antigua—two schools in St. John's and one village school; St. Kitts—one school in Basseterre; Nevis—random sample of rural school children.

Barbados.—Random sample of Bridgetown school children; one school in a representative village.

British Guiana.—Two schools in Georgetown serving poor areas of the city; three rural schools, one serving an estate population on the outskirts of Georgetown, and two on the Berbice coast (one village and one estate).

Jamaica.—Two urban schools (Kingston and Spanishtown); one rural school.

Trinidad.—South Trinidad—one urban school (San Fernando); two estate schools; one school in a rice/sugar area of small proprietors; one school in the cocoa belt. North Trinidad—a further 300 children were seen and evidences were observed similar in kind and amount to those recorded in detail in the above chart.

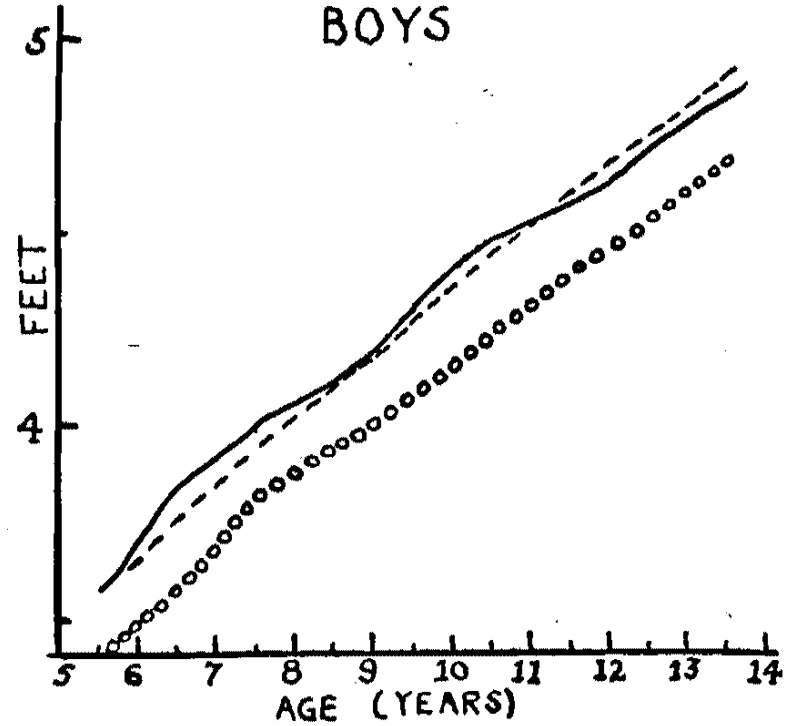
Puerto Rico.—One urban and one rural school.

Fig. 2.

HEIGHT CURVES OF CHILDREN

— WEST INDIES, 1944. ○○○○ LONDON ELEMENTARY SCHOOLS 1905-12
- - - LONDON ELEMENTARY SCHOOLS 1938

BOYS



GIRLS

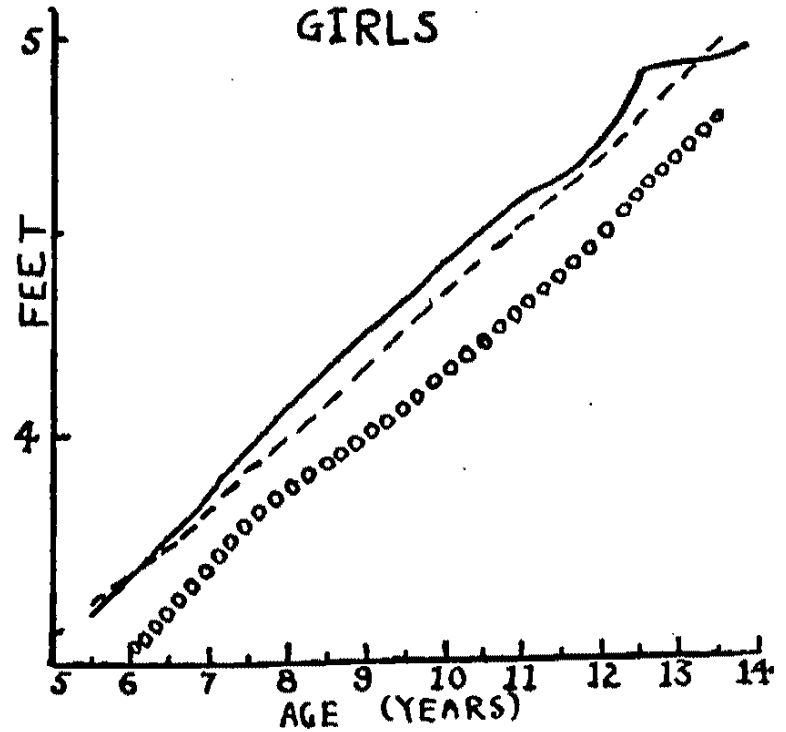
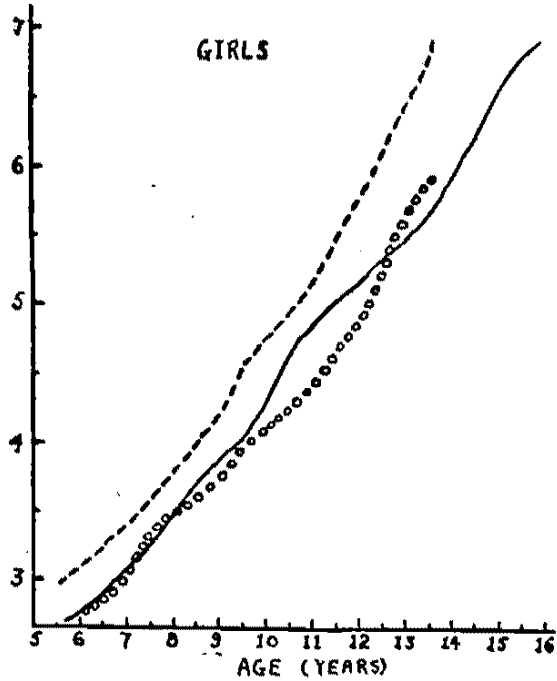


Fig. 2 (contd.).

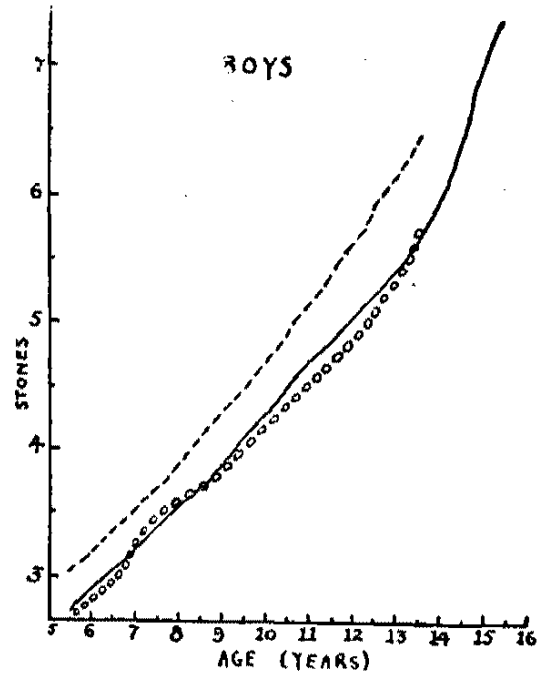
WEIGHT CURVES OF CHILDREN



— WEST INDIES, 1944

○ ○ ○ LONDON ELEMENTARY SCHOOLS 1905-12

--- " " " 1938



— WEST INDIES, 1944

○ ○ ○ LONDON ELEMENTARY SCHOOLS 1905-12

--- " " " 1938

Fig. 3.

NUTRIENT LEVELS OF THE DIETARIES
SHOWN AS A PERCENTAGE OF THE IMMEDIATE OBJECTIVE

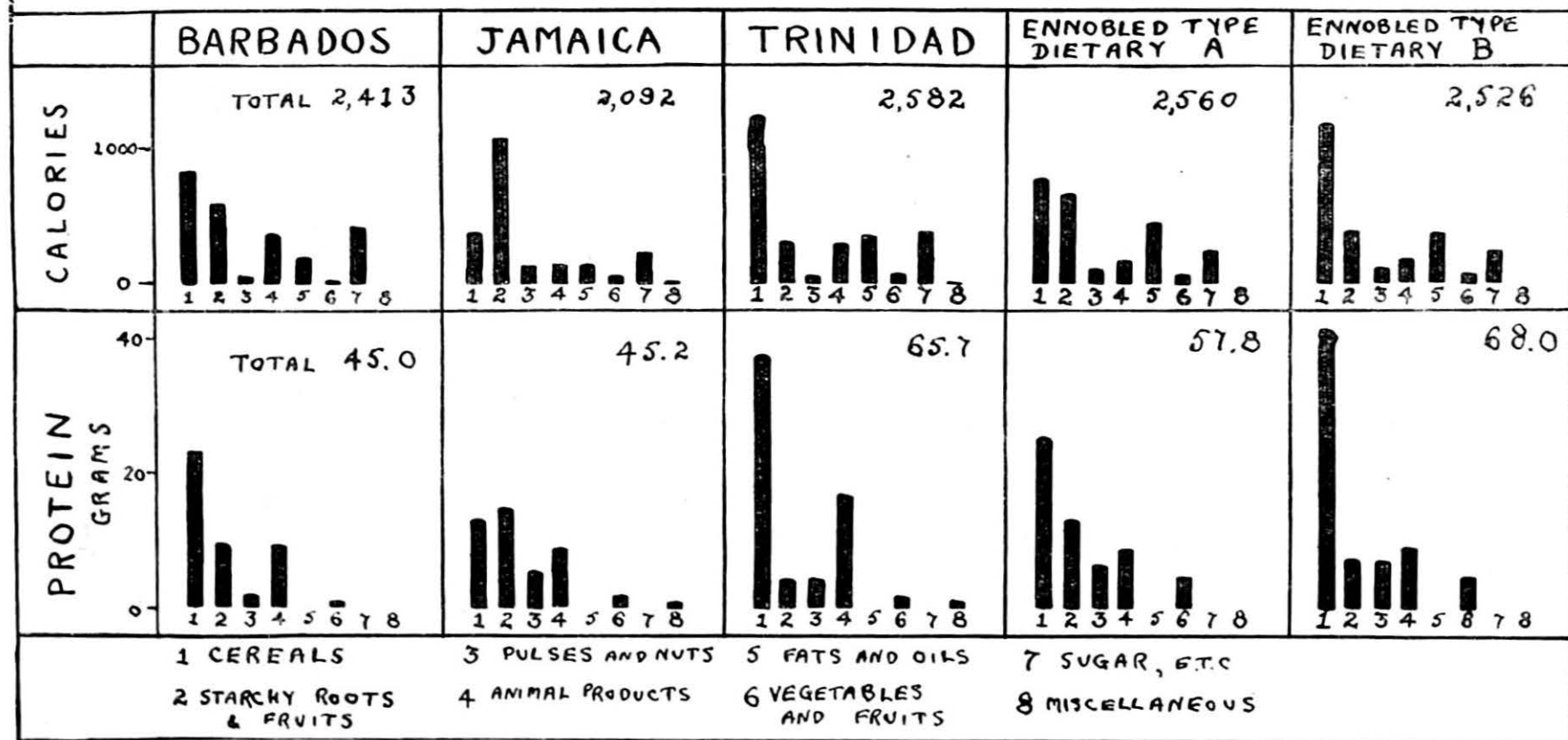
DIETARY	CALORIES %	PROTEIN %	CALCIUM %	IRON %	VITAMIN A %
BARBADOS	95.5	74.9	31.7	60.0	10.9
JAMAICA	80.5	74.9	40.0	7.0	25.8
TRINIDAD	107	110	38.3	65.0	91.7
TYPE A (a)	105	96.6	49.0	89.2	34.7
TYPE B (a)	102	112	51.1	70.0	33.1

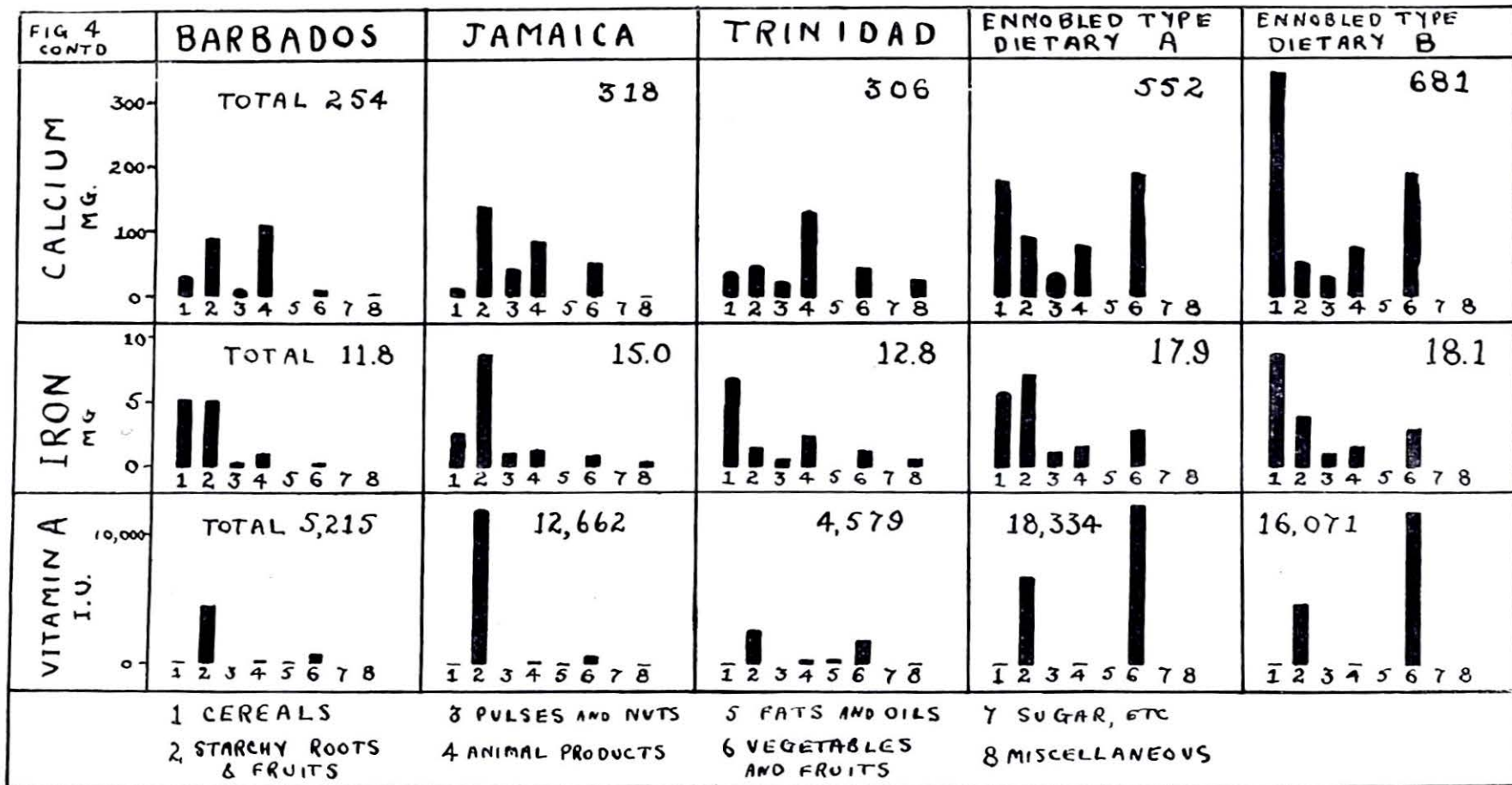
DIETARY	ANEURIN %	RIBOFLAVIN %	NICOTINIC ACID %	ASCORBIC ACID %
BARBADOS	52.0	42.9	50.1	23.0
JAMAICA	42.7	42.8	78.0	53.4
TRINIDAD	67.4	49.5	101	21.4
TYPE A	79.3	48.9	108	63.7
TYPE B	94.6	71.7	114	38.7

(a) FLOUR ENNOBLED
WITH 2% FOOD YEAST
AND 0.5% BONE MEAL

FIG 4

DISTRIBUTION OF NUTRIENTS IN DIETARIES





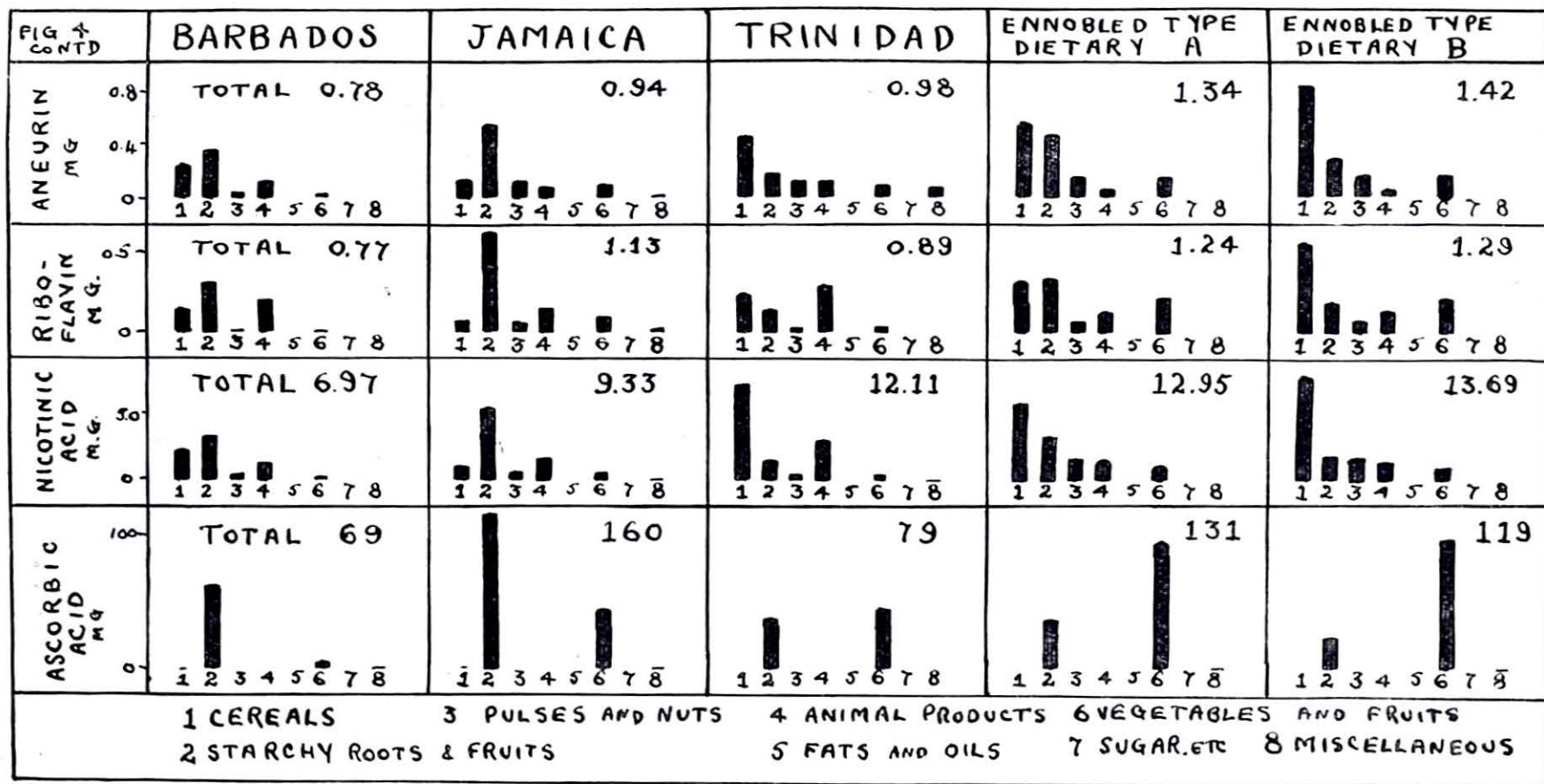
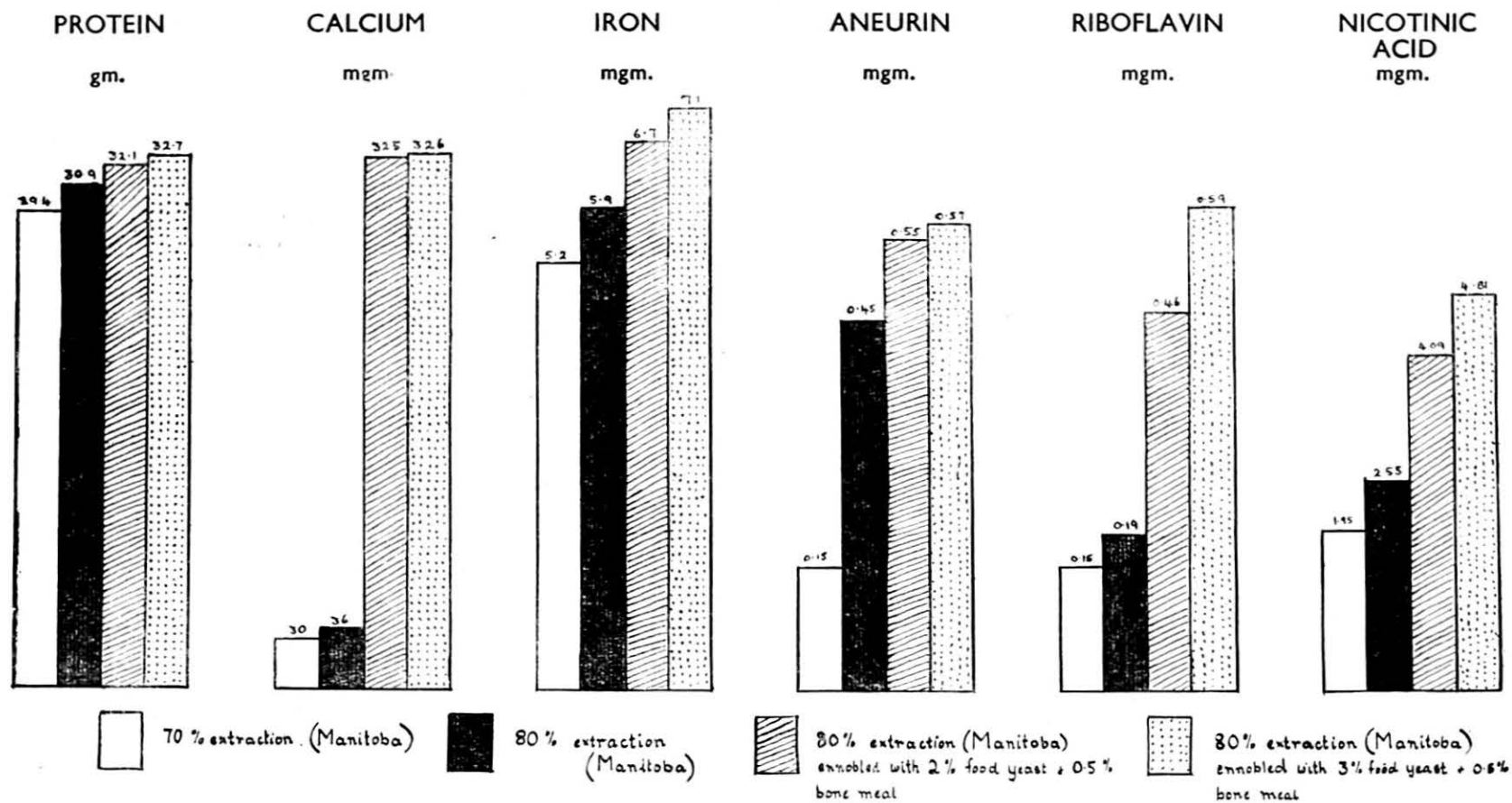


Fig. 5.

NUTRIENTS SUPPLIED BY 8oz. WHEAT FLOUR OF VARIOUS KINDS



DEVELOPMENT AND WELFARE IN THE WEST INDIES 1943-44

Report by

SIR FRANK STOCKDALE, K.C.M.G., C.B.E.
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