BRITISH MEDICAL ASSOCIATION (MOMBASA DIVISION)

Minutes of a meeting of the B.M.A. Mombasa Division held at the Pandya Memorial Clinic on Wednesday 5th Jan. 1955 at 6.45 p.m.

Present: Dr. S. D. Karve (in the chair) Drs. I. S. Patel, S. H. Parekh, Juvekar, Hamin, R. N. Mehta, Nene, Miss S. Figueiredo, Dhillon, C. J. Patel. M. S. Amin, Keating, Haynes, Mackenzie, Goodchild and McVicker.

1. *Minutes of Previous Meeting.* The minutes of the meeting held on 21st June 1954 and 3rd November 1954 were confirmed.

2. *Address by Dr. Harries, M.D., M.R.C.P., D.C.H. D.T.M. & H.*

Dr. Harries gave a very interesting talk on the subject "Positive Pressure Respiration in the treatment of Bulbo Spinal Poliomyelitis", which was much appreciated by all present. The Chairman thanked Dr. Harries.

There being no other business the meeting terminated at 7.15 p.m.

ANNUAL REPORT FOR THE YEAR 1954

Mr. President, Ladies and Gentlemen.

I have pleasure in presenting my Annual Report on the activities of the British Medical Association's Mombasa Division for the year 1st Jan. 1954 to 31st December 1954.

2. At the Annual General Meeting held on 28th Jan. 1954, the following officers were elected for the year under review:—

President . . . . . Dr. Cochrane
Vice President . . . Dr. Karve
Hon. Secretary Treasurer Dr. A.U. Sheth.

Dr. Marshall was re-elected to represent this Division on the Pandya Memorial Clinic Committee.

3. *Accounts.* A Statement of Account for the year 1954 is attached. I am pleased to record that there is a credit balance of Shs. 723/14 on hand as at 31st Dec. 1954.

4. *Meetings.* Six meetings were held during the year 1954 and the following were the subjects discussed at these meetings:—

(1) Interesting cases presented by Dr. J. R. Harries and Mr. D. O'Keeffe and by Dr. A. U. Sheth.

(2) Talk by Mr. J. Fulford Jarvis on the subject "Tumours of the Jaw".

(3) Talk by Mr. S. R. Keating on the subject "Thoracic Surgery in England and America".

(4) Talk by Mr. R. McVicker on the subject "Hip Surgery".

(5) Address by Sir Philip Manson Bahr on the subject "Dysenteric Disorders".

(6) Talk by Dr. Harries on the subject "Positive Pressure Respiration in the treatment of Bulbo Spinal Poliomyelitis".

5. *Cricket Match.* This has now become an annual feature of the Mombasa Division, and as last year, a Cricket Match was arranged and played between members of the Legal and Medical Professions on Sunday, 8th August 1954. This, I regret to report, ended in the defeat of the Medical Side.

6. *Annual Dinner.* A very sumptuous Dinner was arranged at the Tudor House Hotel on Tuesday, 7th Sept. 1954, and among the guests were the Hon'ble the Director of Medical Services, Dr. Anderson, and the Hon'ble Mr. Havelock, Minister of Health to the Kenya Government. I would like to take this opportunity of thanking the President and the Vice President and Members for their co-operation and assistance during the year 1954.

A. U. SHETH,
Hon. Secretary-Treasurer.

The East African Medical Journal

No. 5 MAY, 1955 Volume 32

CALORIE AND PROTEIN REQUIREMENTS OF ADULT MALE AFRICANS[1]

By H. C. TROWELL, O.B.E., M.D., F.R.C.P.
Specialist Physician, Uganda Medical Department.

Received for publication: 16.xii.54

THIS article attempts to review modern knowledge concerning the calorie and protein requirements of adult male Africans in East Africa. Discussion is confined largely to adult males among whom the problem is simpler than among women and children, both of whom need a larger proportion of protein, certain vitamins and minerals in their diet, in order that growth of foetus or child may occur.

One of the principal methods of determining the requirements of any nutriment is to conduct a nutritional survey. The underlying basic assumption is that it is possible by a clinical examination, combined with biochemical procedures, to demonstrate signs of malnutrition. It is almost certain that the calorie content and proportion of protein can be significantly reduced in the diet of adults and yet it will be impossible or difficult to demonstrate this during any nutritional survey. It appears to be possible to adjust to a moderate reduction of calories by a reduction of activity and this will not be noted at most nutritional surveys. Apart from this reduction of activity, the body may remain the same in weight and reveal no biochemical changes. In a similar manner it is impossible at the present time to detect by a clinical examination the effects of an inadequate intake of protein in an adult male unless the deficiency is very severe and prolonged. One of the most urgent problems in nutritional research in Africa is to establish reliable and simple tests for minor degrees of calorie deficiency and protein deficiency, and until these have been devised it will be impossible to determine requirements. Nevertheless, dietary surveys in many parts of Africa reveal low intakes of calories and protein. The Table contains abstracted mean figures from several investigators; for full details it is necessary to refer to the original communications which are listed in the references.

[1]From a paper contributed to East African High Commission Conference on Food and Production, at Kampala, Uganda, in January, 1954.

TABLE

APPROXIMATE CALORIE AND PROTEIN INTAKES OF MALE AFRICANS

Country	Investigator	Calories	Total (gms)	Protein Animal (gms)	Protein Vegetable (gms)	Calories from Protein (per cent)
	Self-fed groups					
Nigeria	Nicol	2250	43	17	26	7·8
Uganda (1)	Statistical Dept.	2200	48	9	39	9·0
N. Rhodesia	Beet	1500	43	8	35	11·7
S. Sudan	Abbott	2400	53	—	—	9·1
	Rationed groups					
Nigeria	Phillips	3000	66	—	—	9·0
Kenya (2)	Henry and Grant	2800	91	18	73	13·3
Recommended allowances (3)		2800-3500	75-95			11·0

(1) Kampala casual labourers.

(2) Nairobi railway unskilled labourers.

(3) As a result of this communication.

THE DETERMINATION OF CALORIE REQUIREMENTS

Before the significance of this apparent low intake of calories can be assessed it is necessary to review briefly the two methods of determining calorie requirements. The first is that of an actual survey of intakes among better-fed sections of the community. These surveys have been widely practised in Europe, America and India; it is, however, possible that in the former continents calorie intakes are slightly too liberal because adults tend to gain weight after the age of twenty-five years. Overnutrition is therefore the commonest nutritional disorder of advanced communities, with increased severity, if not an actual increased incidence of atheroma, hypertension, diabetes and osteo-arthritis (Dillon and Trapnell, 1952).

The second method of determining calorie requirements consists in the determination of the separate items on the energy expenditure budget. These are the basal metabolic rate (BMR) and the specific dynamic action of food (SDA and usually reckoned as 1/10 BMR) and the calories expended on posture, movement and work. Whereas the first two items can be calculated with a fair degree of accuracy and depend largely on the surface area of the body (and so the weight and height) the last item—calories for movement and work—varies from hour to hour and from task to task. It can seldom be assessed with any degree of finality. Thus the British Medical Association Report of the Committee on Nutrition (1950) assessed the calorie requirements of the British male adult of 65 kgs. as follows :—

BMR + SDA	1700 calories
16 hours "up and about" minor activity	370 calories
Walking 2 miles	130 calories
Work (30-300 calories per hour) × 6 hours	180-1800 calories
Total for work ("sedentary" to "very heavy")	2380-4000 calories

It is the task of committees of nutrition to arrive at some round estimate, derived from these two methods, and the most recent and authoritative pronouncement has been the memorandum on "Calorie Requirements" (1950) by the Food and Agricultural Organization. They accepted the fact that work and activity varied so much from one individual to another that they attempted to define only the mean calorie requirements of any *group* of individuals. This they called the requirements of "Reference Man": he is 65 kgs. in weight, aged 25 years, lives in a temperate zone, has a stationary weight, is free of disease and engages in light physical activity such as that of a laboratory attendant.

"Reference Man" they consider should eat 3200 calories daily. The chief value of their report is that corrections are allowed in respect of age, childhood, adolescence, sex, pregnancy, lactation and climatic temperature. No correction is allowed for race for no difference has been demonstrated.

Employing the corrections offered by this Committee it can be stated that the *mean* requirements of African males in East Africa weighing 55 kgs., and engaged only in *light* physical activity at temperatures of 20°-30° C. are 2500-2700 calories daily.

The most important correction, and that responsible for the greatest reduction, lies in the lower weight of most African males; Harvey (1949) and Phillips (1954) would state that in Kenya and Nigeria the mean African adult male weight is approximately 10 kgs. less than that of Europeans. African males usually weigh only 55 kgs.: this is possibly not so much due to genetic, that is racial differences, as to malnutrition prevailing throughout most of the period of growth. When nutrition at this period is excellent, as in the case of breast fed infants, Africans grow as fast, if not faster, than European babies (Welbourn, 1951). After weaning almost all African babies grow more slowly and seldom rise ever again to the plane of growth and nutrition which prevails among European and American communities and among American negroes. Much more knowledge is required concerning growth at this period.

No corrections were offered by the FAO Committee in respect of the extra calorie requirements of manual labourers, undergoing hard work, in communities where mechanical aids have not lightened toil or even walking. The FAO figures should not be applied to culturally retarded areas such as those of tropical Africa. In this connection the communication of Phillips (1954) on the calories expended by Nigerian porters at set tasks is very important for it is the first assessment in tropical Africa. He estimated oxygen consumption by the Douglas bag on seven Nigerian porters whose

mean weight was 55 kgs., and found the following consumption of calories per hour at the following tasks: sitting and or standing 76, walking 184, log (20 kg.) carrying 213, grass cutting 269, hoeing 274, bush clearing 372, sawing 360, tree felling 504. It should be noted that these are figures of calories per hour of *continuous* activity, which is impossible in any worker. Phillips observed that about half the working hours were expended on continuous activity, the remainder being consumed in minor activity, preparations for work or rest periods.

Assuming that "light physical activity" consumes only about 100-200 calories per hour but "hard work" would consume 200-400 calories per hour, it would appear that about 3-4 hours of continuous hard work by African porters would consume an *extra* 300-800 calories. "Reference African Man" in East Africa should therefore be *offered* 2500-2700 plus 300-800, that is 2800-3500 calories per day if engaged in "hard" physical work. It should be palatable, well-cooked food; whether he will eat it or not is uncertain; that depends on appetite which still remains the best indication of calorie requirements *provided the food is appetising.*

UNDERNUTRITION

If a diet is correctly balanced in respect of the proportion of all desirable nutriments, but is reduced in amount, so that calorie requirements are not satisfied, calorie deficiency dominates the response of the body, other deficiencies being also present but are probably less important, and the condition is spoken of as one of undernutrition. There has been until recently little study of the signs which accompany mild undernutrition, even those accompanying severe undernutrition are less commonly understood.

In view of recent work it is suggested that mild undernutrition produces :—

1. Reduction of all non-occupational activity and also of work unless the latter is manifestly directed towards overcoming hunger (e.g., more energy may be displayed at planting crops, but less work may be done by those who earn a standard pay). It is possible for reduced expenditure of calories to close completely the "calorie gap", with abolition of hunger and the striking of a balance at a lower level of intake.
2. Unsatisfied hunger. Little is known concerning whether this becomes less intense if undernutrition is prolonged, or if there are psychological incentives (e.g., an overweight European who desires to slim or Africans who regard food shortages as customary prior to the harvest).
3. Loss of weight if the "calorie gap" persists, and a reduction of the weight/height ratio.
4. A sense of fatigue, especially on exertion, may be experienced.
5. A correction of all these phenomena on offering increased amounts of appetising food.

The signs of severe undernutrition are now well understood and include hunger which dominates and perverts the mental outlook, so that the moral code deteriorates; loss of weight, especially of subcutaneous fat. There are few biochemical changes or morphological changes in the tissues until shortly before death. Appetite is well preserved, the serum proteins may fall and oedema may occur in advanced cases of undernutrition.

FINAL EVALUATION OF LOW CALORIE INTAKES OF CERTAIN AFRICANS

This largely resolves itself into whether Africans feel hungry. The "hungry months" are clearly recognized in most areas of Africa in which there is one rainy season; what is not generally recognized is that, even in areas such as most of Uganda, those who live actually in the countryside, as does the author, are conscious that there are periods of food shortage. This is largely due to poor techniques in storing food. Subsistence peasant agriculture in Africa has seldom given each day the daily bread.

It should be noted that even in town labourers, to whom food is issued, calorie intakes assessed at nutritional surveys (Table) tend to be low (2800-3000) for "hard" physical work. The latter may be possible if Africans have learned to avoid physical recreation and sleep or recline at the slightest provocation.

In the last resort, with existing techniques, it is impossible to resolve this problem which can be stated thus: Do Africans eat less because they play less and work less, and fidget less, or do they work and play less because they eat less? The link between work and eating and eating and work is always a psychological one; it involves motives, desires and appetites. Whether Africans have adjusted their activities to meet their calorie intakes (or vice versa) is not easily answered, especially in adults who may have certain mental and physical habits. The path to the answer can only lie through a study of children, and common observation suggests that many African children, from an early age, are distinctly less active than European children. Is this due to association with lack of stimulus in the parents and in the environment or does it reflect a nutritional check? This is a psychosomatic problem which cannot be resolved in adult life when habits have become ingrained to a certain pattern of movement and thought, work and feeding.

There are probably two important gaps in our existing knowledge, which might influence considerably the assessment of the problem of low calorie intakes among African male adults. Firstly, most surveys of African diets stress the low fat content; fat is chiefly of value because it is the most concentrated method of administering calories and also because, if fats are too low, then food becomes unpalatable. The second point is that at tropical temperatures many forms of physical activity may produce a feeling of discomfort long before it is possible to recognize "climatic stress", as the latter is usually defined. In other words adults and children may not find pleasure but discomfort in physical activity that would be normal in temperate regions. This conception may be fundamental in the problem of low levels

of cultural achievement in many areas of the moist warm tropics, especially those having little seasonal change. Other warm areas, particularly if they are dry and can store cereals, especially if there is much seasonal change, have produced outstanding cultures, as in Egypt, the Middle East and India.

PROTEIN REQUIREMENTS OF ADULTS

Far less is known concerning the protein requirements of adults, although at one time categorical statements were made, and are still quoted by those who are poorly informed of modern teaching. The latter is epitomized in a sentence taken from the British Medical Association Committee on Nutrition (1950): "the protein requirements of groups of individuals cannot yet be assessed with any certainty".

There have been largely two approaches to this problem. The first estimates protein intakes in a dietary survey combined with clinical examination for signs of protein malnutrition. The BMA Committee (1950) surveyed intakes in Great Britain and found that protein contributed 11 per cent of the calories in adult males, and 14 per cent in children, adolescents, pregnant and lactating women; 47 per cent of the protein came from animal sources even when war-time rations were issued. For reasons which cannot be discussed in detail here this Committee discussed first whether calories were adequate and then subsequently the *proportion* of protein, for it is little use speaking of protein adequacy unless the calories are sufficient. If calories are low then protein may be diverted to meet energy requirements. Dietary surveys in Britain, which demonstrate that in male persons protein contributes 11 per cent of the calories and 47 per cent is of animal origin, do not answer the problem of whether any ill-effects result if lower intakes occur (8-9%, see Table), especially that of animal origin (20% in Table) as in Africa, especially if, in addition, the intake of calories is low, for this will depress still further the *total* intake of protein.

It might be considered that signs of protein malnutrition could be detected by a clinical survey—but the difficulties are discussed later—combined with an estimation of the serum proteins. The latter are affected in many infections and do not reflect well the adequacy of protein in the diet. Two statements may be given in support of this: "It is doubtful whether moderately low concentrations of serum proteins can be regarded as evidence of inadequacy of protein in the diet" (BMA Committee on Nutrition, 1950). "Recent investigations by a number of workers in widely separated localities have shown that serum protein levels do not reflect the level of protein nutrition or the level of recent protein intake except under conditions of extreme malnutrition" (Joint FAO/WHO Expert Committee on Nutrition, 1951).

One of the fundamental difficulties of assessing whether African adults eat too little protein lies in the fact that there is considerable uncertainty about what are normal protein requirements. Thus Sayhun (1948) has reviewed experiments designed to estimate protein requirements to maintain nitrogen equilibrium in adult men: the figures mostly ranged from about 20-45 gms.

with only one figure over 50 gms. On an ordinary mixed diet Bricker, Mitchell & Kinsman (1945) considered that 27.6 gms. of protein were adequate. Again, in recent years many attempts have been made to study the effects of low-protein adequate-calorie diets in hypertension; these results stress that adult men may apparently remain in positive nitrogen balance and with normal serum proteins on diets containing as little as 20 gms. of protein daily (see a summary in Nutrition Reviews, 1953).

If these estimates are correct then it is probable that there are very few, if any, healthy African adults who are on protein-deficient diets. It is possible, however, that the last word on the vexed question of protein requirements of adult males has not been said, especially when, as in Africa, it is coupled usually with low calorie intakes.

One obvious line of advance in the study of protein requirements at all ages might be to survey the population for signs of kwashiorkor, for it is generally admitted that this disease-process is due to diets deficient in protein. Two difficulties are at once encountered, firstly the detection of mild degrees of kwashiorkor and secondly the peculiar age-incidence of this disease. There is general agreement about severe kwashiorkor in children, all of whom show oedema and a very low serum albumen, but it is almost certain that surveys of children, even at the most susceptible age, that is the second year of life, and in areas in which the disease is considered to be prevalent, would reveal that under 1% of the children have severe (or manifest, or established) kwashiorkor. Almost everyone who has worked with the disease recognizes that there exist at this age many more cases of mild kwashiorkor, but that it is difficult to distinguish these children from those whose growth has been retarded by underfeeding or infection. Until there has been more study of these children, both clinically and biochemically, there can be no accurate survey of protein malnutrition in children. Until it is possible to do this it is impossible to say if a child has been on a protein-deficient diet.

The second difficulty is the peculiar age incidence of kwashiorkor: very few cases occur after five years of age and I have during twenty-five years only encountered three cases during adolescence when growth is slightly more rapid and protein requirements are presumably slightly higher. This would suggest that at these ages the diet is seldom *grossly* deficient in protein; it is possible that it is *slightly* deficient, but this cannot be established. Yet it appears to be the same diet as that eaten by the young child who at two years of age may get severe kwashiorkor. This can possibly be explained by the fact that rapidly growing infants need a higher proportion of protein in their diet, or to some unusual cause encountered only commonly at that age. If the diet appears adequate or almost adequate in its protein content during the growth of later childhood and adolescence, it presumably might be even more adequate for adults in whom somatic growth has ceased.

It is now possible to return to the question of African adult males: do they ever suffer severely or mildly from an inadequate intake of protein? It might be considered that clinicians should be able to detect cases of severe

protein-deficiency and that on general grounds they might display many features encountered in kwashiorkor. Do adult Africans ever get severe kwashiorkor? I have tried to answer that question in a book on kwashiorkor (Trowell, Davies & Dean 1954) and briefly I might state my view as follows: African adults suffer occasionally from a disease-process which is very similar to, but not quite identical to, that seen in kwashiorkor in young children. African adults seldom show much depigmentation of the skin, large black peeling plaques of dermatosis are seldom seen on the pressure areas of the inguinal region and trunk, adults appear to show less gastro-intestinal upset, but more wasting, they respond better to diet. This disease, in my experience, only occurs in adults who have fed for many months on monotonous diets containing a small proportion of protein; manifest ill-health and oedema are very uncommon unless in addition to the deficient diet some extra strain, usually another disease, is thrown upon the person. These cases are seldom cured by high-protein high-calorie diets alone; it is necessary in most cases to look for and attempt to deal with the secondary strain factor; this may be many hookworms, which cause iron-deficiency and finally anorexia and low intake of all foods, or tuberculosis or massive albuminuria or many other conditions. Diet alone can cure those who have engaged in excessive work and long marches, especially if the subjects are put to bed (Trowell & Muwazi, 1945). In my experience *dietary* protein malnutrition seldom displays itself as overt disease in adults; these persons, however, do not stand up well to certain infections (e.g., viral hepatitis and tuberculosis) or stresses which would probably produce few symptoms in those who are better fed.

Thus it is certain that many African adults show signs of "protein-deficiency"; that is to say they have oedema, low serum proteins, and probably low tissue proteins, all of which improve on giving high protein diets; what is not clear as yet, in my opinion, is how far this deficiency is due to defective diet, defective digestion, absorption and metabolism, or excessive losses or liver dysfunctions and diseases. Only that which is due to defective diet can be prevented by improving the diet, and there is much to commend the restriction of the term "protein malnutrition" to this *dietary* group and to refer to the whole syndrome whatever its aetiology as that of "protein-deficiency". Thus one type of "protein-deficiency syndrome" has been studied very fully in nephrosis and nephrotic nephritis, in which massive albuminuria depletes the body of protein, yet in this condition the pancreatic and hepatic changes of kwashiorkor have never been described so that a valid distinction can be made. There are many causes of a "protein-deficiency syndrome".

Although as clinicians we can often diagnose a "protein-deficiency syndrome" in an adult, yet it is not possible for us to get the problem much further, unless the patient is cured by a protein-rich diet, *and no other measure*, in which case one may diagnose "dietary protein malnutrition". Great interest and importance must therefore be attached to the studies in protein

metabolism of Holmes, Jones & Stanier (1954) and Stanier & Holmes (1954). This has been the first comprehensive attempt to study many of the overall aspects of adult Africans showing signs of what I have ventured in this article to call a "protein-deficiency syndrome". This investigation was carried out on sick Africans who had been admitted to the medical wards at Mulago Hospital, Kampala. These patients, as far as could be assessed, had all been on diets containing a low proportion of protein, especially animal protein; many of them had a fairly heavy load of hookworms, and some had manifest signs of advanced cirrhosis. One aspect of the problem was to assess the time which might elapse during which high-protein (180 g day) diets could be given until the patients came into nitrogen balance, as presumably this should give some indication of the severity of the protein deficiency. The investigators were obviously perplexed to find that the protein deficiency could apparently not be corrected by many months of high-protein feeding. Patients also, after some preliminary gain of weight, often tended to remain stationary while apparently storing large amounts of nitrogen and possibly calories, since 3000-4000 calories were consumed daily by persons who were not working and were in-patients.

In kwashiorkor in children the protein content of the liver may be reduced by as much as 40% (Waterlow, 1954) and a comparable figure has been offered in a review of the effects of low-protein diets on the liver in experimental animals (Munro, 1954). It is generally considered that the liver is one of the organs most sensitive to protein-deficient diets. The human male adult usually contains slightly more than 1.0 kg. of nitrogen in the entire body; it will be of great interest to find the amount of nitrogen which can apparently be stored in protein-deficient African adults and whether it exceeds 0.4 kg. of nitrogen (40% of the total nitrogen). These and other matters are engaging the attention of the investigators at Mulago Hospital, and it is essential to consult their communications to assess the complexity of the problem and the many checks imposed to test the validity of the results.

While these investigations are proceeding and the apparent anomalies as yet not fully explained, it would appear premature to assess the significance of these experiments to the problem of protein requirements of the African. On the whole these experiments support the point of view that diets for adult males are probably inadequate in protein; they lend little support to the idea that they are adequate.

TOWARDS A NEW OUTLOOK

It is conceded that it is impossible at the present time to conduct nutritional surveys in Africa to assess whether diets have been adequate in calories and protein, for mild states of calorie deficiency and protein malnutrition cannot be detected. There is therefore all the more necessity to study severe malnutritional and deficiency states in hospital and subsequently to study milder states in the general population. Although at

the present these cannot be precisely defined, yet, speaking as a clinician, many cases of unsatisfactory growth are seen in children and many adults appear thin, weak, and are prone to develop many diseases, especially liver diseases, which are not encountered in better-fed groups. Many of these children and adults appear to desire a better diet and to benefit from it if offered. The present writer is firmly of the opinion that there is a great deal of malnutritional disease in African children and adults, even if it cannot be at present proved.

The problem of nutrition has been oversimplified into undernutrition on a well balanced diet and malnutrition, of which there are many groups, one of which is that of protein malnutrition, and one member of this group is kwashiorkor. Experimentally there have been many attempts to define the effects of single deficiencies of calories, of protein or of a single vitamin; the method has been to take adults (humans or animals) previously well fed, and to produce suddenly a single severe deficiency, or the effects of this single deficiency have been studied in growing animals.

That section of mankind which is poorly fed does not eat thus. After weaning many of them are on monotonous diets, which are rather low in the proportion of protein and fat, and from time to time there is a shortage of food for economic or agricultural or social reasons. Growth in early childhood is poor. Infections are frequent and may further decrease intake of all nutrients, especially if they cause fever or severe anaemia. Adults eat the same diet and there occur recurrent periods of reduced food intake of a low-protein, low-fat, low-vitamin diet and periods of refeeding, often on single foods, when a period of prosperity occurs. Certain adjustments are made to this diet, but disease processes also eventuate in the body. These processes are varied; they are not merely those of undernutrition or protein malnutrition, which are merely two ends of a complex spectrum. Calories and protein intakes are usually waning and waxing in a recurrent manner and a new terminology or conception of disease is required.

SUMMARY

A review is offered of the present status of knowledge concerning calorie and protein requirements of African adult males in East Africa. Discussion of the more complex needs of children, pregnant and lactating women is avoided in order to conserve space.

Dietary surveys in tropical Africa often, but not always, reveal a calorie intake of 2200-2400 and protein 43-53 gms. (8-9 per cent of the calories) per day.

From the FAO Memorandum on Calorie Requirements (1950) it can be calculated that 2500-2700 calories are required daily for African adult males, weighing 55 kgs., aged 25 years, engaging in *light* physical activity at 20°-30°C. Estimates of calorie expenditure by African porters in Nigeria suggest that this figure for Africans should be increased to 2800-3500 calories because of hard physical labour at unmechanized tasks.

If Africans take less than their calorie requirements it is probable that they will adjust by decreasing work and all forms of movement; ultimately weight loss and signs of undernutrition appear. It is not known if they eat less because they work less or vice versa.

The protein requirements of adults are not known with any degree of certainty. It is advisable that protein should contribute 11 per cent of the calories; surveys indicate that many African diets have only 8-9 per cent. In young children, who need proportionally more protein, severe kwashiorkor may result, but in adults this is a rare condition. There are no techniques at the present time to detect mild inadequacy of protein in the diet.

Calorie deficiency and protein deficiency cannot be studied in isolation. The most common fault of African diets is that they are at certain periods low in calories, lower still in protein (especially animal protein), and if this is combined with an infection, subsequently excessive refeeding may occur. Against this background abnormal disease patterns occur, such as chronic hepatitis, and it is unlikely that many of these are explained in terms of a single deficiency or infection.

References

Abbott, P. H. (1950) *Trans. Roy. Soc. trop. Med. Hyg.* **43, 477.**
Beet, E. A. (1951) *Arch. Dis. Child.* **26, 119.**
Bricker, M., Mitchell, H. H. and Kinsman, G. M. (1945) *J. Nutrit.* **30, 269.**
Calorie Requirements. Report of the Committee on Calorie Requirements. Food and Agriculture Organization of the United Nations, Washington. 1950.
Dillon, E. S. and Trapnell, J. M. (1952) *Trans. Assn. Life Insur. Med. Direct. Amer.* **35, 280.**
Harvey, D. (1949) see *African Labour Efficiency Survey* edited by C. H. Northcott. Her Majesty's Stationery Office, London. 1949. P.95.
Henry, J. H. and Grant, M. W. (1949). *Ibid.* P.96.
Holmes, E. G., Jones, E. R. and Stanier, M. W. (1954), *Brit J. Nut.* **8, 173.**
Joint FAO/WHO Expert Committee on Nutrition. Report on the Second Session, Rome, **1951.**
Munro, H. N. (1954), *Pro. Nut. Soc.* **13, 115.**
Nicol, B. M. (1949), *Brit. J. Nut.* **3, 25.**
Nutrition Reviews (1953). **11, 193.**
Pattern of Income and Expenditure and Consumption of African Uskilled Labourers In Kampala, September, 1951. East African Statistical Department, Nairobi, 1951.
Phillips, P. G. (1954), *J. trop. Med. Hyg.* **57, 12.**
Report of the Committee on Nutrition. British Medical Association London. 1950.
Sahyun, M. *Proteins and Amino-acids in Nutrition.* New York. 1948.
Stanier, M. W. and Holmes, E. G. *Brit. J. Nut.* **8, 155.**
Trowell, H. C., Davies, J. N. C. and Dean, R. F. A. (1954). *Kwashiorkor.* London. 1954.
Trowell, H. C. and Muwazi, E. M. K. (1945-46) *Trans. Roy. Soc. trop. Med. Hyg.* **39, 229.**
Welbourn, H. F. (1951), *E. Afr. Med. J.* **28, 423.**
Waterlow, J. (1954), *Proc. Nut. Soc.* **13, 135.**