NUTRITION

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Energy or Calories

The words energy, work and heat are often used as if they were one and the same thing. To the layman 'energy' means the capacity for doing work which the scientist calls power. To the scientist, energy is the fundamental reality prevading all in this universe. Any matter can be resolved in the units of electrical energy. The sun is the main source of energy and all life depends on it. It appears as electrical energy, as light, as muscular work, as machine work or as potential energy present in the reservoir of water such as the water falls from which electrical energy could be generated for purposes of lighting and power. It will appear from this that energy appears at one time in one form, while at another in a different form, and is convertable. Living plants store energy in the seeds, tubers, fruits etc., on which man lives and derives energy. Plant in ages past having imprisoned energy in its tissues dies and leaves a heritage of coal which is used by us as a source of heat. Every muscular movement, even the secretion of a drop of saliva or sweat liberates energy and all this comes from food. Hence the study of food as a source of energy is of great importance to the dietetian and nurse. Our source of energy is no doubt food but the dietetian wants to know how much energy the human body needs, and, therefore, how to measure it.

As energy is indestructible and intra-convertible, it does not matter in what form we measure it, but for convenience sake it is preferred to measure it in thermal units called 'calories'. The calorie is the amount of heat required to raise the temperature of one kilogram (2·205 lbs.) of water to one degree Centigrade. The calorie determines the energy value of food. For a normal healthy adult Indian in moderate work, we suggest 2,400 calories a day.

There are two ways of measuring the calories required by man : one by human calorimetery and other by food calorimetery. Human calorimetery consists of measuring the heat given out from the body, the oxygen absorbed, and the carbon dioxide and water given out by the subject. Calorimetery of food is carried out by finding out the heat produced by burning food in a bomb calorimeter as also the calorie value of the excreta produced during the experiment and the calorie requirement is the total heat in-taken with the food, minus the heat output in the excreta. Both these are good methods but are time consuming and not of any use for ascertaining the caloric value of the diet of a family or an institution or a nation. It has been ascertained that the average energy of a gram of nutrients is : 1 gram protein=4 calories ; 1 gram carbohydrate=4 calories ; 1 gram fat=9 calories. Tables have been prepared by almost all countries of their foods showing their caloric value and from these one can easily assess the calorie intake of an individual. Such analysis tables are good for each country by itself and the value of a food reported by one country should not be recklessly used by another. The second point to be kept in mind is that food tables do not

give exact composition but only approximation since the constituents vary from sample to sample. The third is that when made dishes are eaten and values to be calculated, it must not be assumed that the recipe used is that of the sample analysed, nor is the time and nature of cooking the same. The utmost that can be done is to obtain the nature of the recipe and allowance made for loss in cooking. There are different methods of assessing the food intake: the individual method, house-keeping method and the budgetary method. Of these the first is to be preferred. The individual method consists of weighing the food at the table and noting the weight of the food actually consumed by the person and this is done for seven consecutive days, at the end of which the values are computed and average intake calculated. In some of the analysis when we weigh the foods to be consumed in the raw state, it must be clearly understood that there may be considerable difference between the values of the "as purchased" food and the "edible portion". The edible portion will be less than the "as purchased" food since the skin, bones, seeds etc., have to be discarded, and in some cases the weight of the former may be reduced considerably, while there may be no change in others. In bread, biscuits, butter and cakes, the edible portion would be 100 per cent; while in meat about 83 per cent, fish 40 per cent, melons 40 per cent and walnuts as low as 26 per cent, so it will be realised that one pound of "as purchased" will have a lower calorie value than one pound of edible portion. When computing the calorie value of a diet this has to be borne in mind. When the diet of a family is being assessed on the "as purchased" basis, the values have to be computed accordingly. Another point to be borne in mind is the table wastage and wastage of foods like fat. In assessing the diet of an individual it is not difficult to assess the table wastage but in case of a family it is not so easy. It is usually assumed that in the diet of a family assessed on "as purchased" basis, there is a loss of 10 per cent of the total weight of foods in the process of cooking and eating and working on this basis the total calorie intake should be calculated accordingly. We have in this way a means of assessing the calorie intake of a person or family.

Often we wish to know the average value of the diets of a group of people whether of a family, institution or nation.

If the family is the unit, the food in the house at the beginning of the investigation is estimated and allowance is made for that at the end of the period. All food bought during the period is weighed and so also the wastage. The total food consumed is equal to that of each article at the beginning, plus that bought during the time minus that at the end, minus the waste. The members of the family of different ages and sexes are converted in terms of an adult male by the conversion factor given below and this gives the intake per head of the family which is obtained by dividing the total intake by the number of days and the total number of adults in the family.

	Factor.
Adult Male	... 1·0
Adult Female	... 0·9
Children 9-12 Yrs.	... 0·8
7-9 ,,	... 0·7
5-7 ,,	... 0·6
3-5 ,,	... 0·5
1-3 ,,	... 0·4

Much the same method is used in the cases of an institution such as a school or an orphanage. This method gives a satisfactory and understandable result.

In the budgetary method, the aim is to ascertain whether the income of a family is sufficient to give a satisfactory diet rather than to discover whether it actually does. The investigator estimates the family income from which is deducted all expenses of the same except that for food. The total amount of money

available for food is converted in terms of the actual food that could be purchased on the basis of prevailing market prices. From the tables, the total available calories are calculated. All the members of the family are reduced to adult males by those of the conversion factor and the available calories when divided by this, and the number of days of which the income has been assessed, gives the amount that the family is getting per head per day. Such investigations are useful in assessing the needs of people for public assistance. Such investigations made in England have shown that the main cause of mal-nutrition is poverty due to a large family.

We have been discussing the question of heat required and given out by the body. The question arises, is there anything fixed and constant in the energy output of an individual and does the human body ever behave like a machine in the sense that so much food would produce so much of energy. The answer is that it does and this is provided in the Basal Metabolism. When the intake is less than input, or there is no intake as in starvation, the body burns its own fat, muscles etc., to sustain the flicker of life. In basal metabolism the loss of heat is minimum and that energy is required by an individual, when absolutely at rest in bed, to keep the lungs and heart working, glands secreting, kidneys functioning and so on.

This heat output varies with age, race, sex, height, weight, and state of nutrition of an individual. The basal metabolism of a female is lower than that of a male.

The basal metabolism of children is 50 per cent higher than adults. There are other factors also affecting the basal metabolism *i.e.*, under nutrition and myxoedema lower it, and fevers increase it.

It does not need to be emphasised that the total metabolism of an individual bears relation with the basal metabolism. The former includes the work done in carrying one's body and so varies with body weight. Physical work undertaken considerably influences the total metabolism, heavy work still more and this entails increased consumption of food. If we have a regulated life we might say that the 24 hours of the day is divided into 8 hours of sleep, 8 hours moving about and 8 hours working. The calculated daily calorie requirement will thus be :

8 hours sleep at a basal rate of 70 calories an hour ... 560 calories.

8 hours 'morning' at 33 per cent higher than basal rate ... 747 calories.

8 hours work at 75 per cent higher than basal rate plus the figures for 'morning' ... 1687 calories.

Total... 3,000.

In view of the lower basal metabolism of Indians, the 'basic' calorie requirements have been reduced to 2,400.

Important Notice

The Nurses, Midwives and Health Visitors who are registered in the Bihar Nurses Registration Council are requested to send their present address to the Registrar, Bihar Nurses Registration Council, Secretariat, Patna, Bihar in order to enable this office to bring the Register up-to-date.

Sd/- A. MUKOPADHAYA,
Registrar,
Bihar Nurses Registration Council.