with food and time but rather outside my terms or reference, as growth is no longer on the " agenda ".

REFERENCE

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NUTRITIONAL INDIVIDUALITY*

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A hundred years ago Claude Bernard wrote in his *Introduction to Experimental Medicine:* " Physiologists and physicians must never forget that the living being is an organism with its own individuality ". A lot of us have forgotten this, especially the administrators, because they always think in terms of population and averages—the average body-weight for a given age or height, the average requirement for this or that. If they think of the individual at all, it is the average man weighing 70 kg., and probably this hypothetical average man never existed. The doctor, on the other hand, deals with the individual, and to him the range of variation that can exist from one perfectly normal person to another is much more important than a single mean, which is often wrongly interpreted as being synonymous with the normal. We are now beginning to realize how very widely normal healthy people differ from each other in all sorts of ways, and I would like to discuss a few of the physiological characteristics over which we have little or no control, and which influence our nutritional requirements.

My attention was first drawn to this in 1936, when I studied the individual food intakes of 63 men and 63 women of the English middle classes. Up to that time dietary surveys had generally been made on families, and no information was obtained about the individuals within those families. I was at once struck by the enormous variation in calorie intake from one person to another. Both groups contained men or women who were taking half as many calories as others. This is not peculiar to adults, for when I later made a similar study on over 1,000 children I found that in every age group from 1 to 18 years one boy or girl out of the 20 or

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more in the group took twice as many calories as another. A 16-year-old boy and a 15-year-old girl took fewer calories than one-year-old children. I found that the variations were evident by the first year, and more recent studies made by the Child Research Council at Denver show that this same variation is happening right from birth; out of a group of 22 infants in the first month, one habitually took 250 calories a day at a fortnight old and another 615.

Big children do not necessarily take more calories than small ones, for the calorie intake per kilogram of body weight varied almost as much as total calories. One 3-year-old boy took 158 calories per kilogram per day, another 70. It might be supposed that the explanation of these variations is that a child who eats more than the average one week will be eating less than the average the next. It is quite true that the calorie intake varies considerably from day to day, but when the intake is averaged over the week, one week is very much like another. For example, one girl of 3 years took about 1,100 calories a day on each of four successive weeks, while a boy of 4 years took regularly about twice as much, and another girl of 4 took an amount of food which provided calories in between the other two.

In the studies made in Denver the food intake of the same children has been measured periodically over the whole of the growth period, and it has been found that a child who is eating little at one time will still be eating less than the average later. I think we must conclude that the big eater remains the big eater, and the person who eats less than the average will in all probability be eating less than the average in a month's or a year's time. Of course, there are occasions when we all eat more than usual, and others when we feel off-colour and eat less, but we have to conclude from these studies that we do not all eat, and do not all require, the same amount of food.

The reason for this variation in food requirement has still not been completely explained. Differences in physical activity go part of the way towards explaining it, but by no means all the way. The basal metabolic rate is also important, for we realize now that this varies among healthy individuals much more than we used to suppose. For example, the basal metabolic rate of a series of 36 normal men and women varied from below 80 per cent of the standard normal to over 120 per cent. The energy expenditure while " sitting " varies in a similar way and, since most people spend 70 per cent of their time lying and sitting, we thought at one time that these variations would go a long way towards explaining the differences in people's energy requirements. However, it is not quite

as simple as that, for there seems to be very little relation between a person's basal metabolic rate and his total energy intake and expenditure. Rose and Williams measured the basal metabolic rate in large and small eaters and came to the same conclusion, namely, that the small eaters did not necessarily have a low basal metabolic rate, nor did the big eaters have a high one. One thing we must remember, however, is that when a person has his oxygen consumption measured for the purpose of estimating his basal metabolic rate he must lie still and not fidget; in fact, the measurement is repeated until the lowest possible reading is obtained. The same applies when the oxygen consumption is measured while " sitting ", but this is not how many people lie and sit, for they move and fidget all the time, and some fidget much more than others. Fidgeting may almost double the oxygen consumption and it seems likely that while for some people the recorded value for oxygen consumption under basal conditions bears some approximation to the usual oxygen consumption, for some people this may be very far from the truth, and the variation in energy expenditure while lying and sitting may be far greater than we even now suppose. If we measured the oxygen consumption under more realistic conditions we might get a little nearer to the explanation of the variations in calorie requirements.

As far as we know, the appetite is regulated on total calories, and not on any individual dietary constituents. On the whole the person with a big appetite who takes the most calories will automatically get more of each of the separate dietary constituents, including the minerals. Does this matter? Does the person who needs and takes the fewest calories also need the least calcium for example? The laws governing the requirements for calories and for calcium seem to be completely different and there is no relation between them. The person who has a low calorie requirement and eats comparatively little food may well have a calcium requirement above the average, although his intake will probably be below. An imporant factor in determining a person's calcium requirement is his ability to absorb dietary calcium from his intestine. Variations in losses by the bowel are negligible when it comes to accounting for differences in calorie requirements, but they are very important in the case of minerals like calcium. Some people are good absorbers of calcium whilst others are bad absorbers, and this is true whatever type of diet they are eating. The amount of calcium in the diet influences the amount of calcium absorbed, but a person who absorbs well on a low intake will also absorb better than the average on a higher one.

Two characteristics that are related to the facility with which a

person absorbs the inorganic constituents from his diet are the rate of passage of material through the intestine and the amount of faeces passed each day, and on the whole, the more rapid the passage, the greater the volume of stools and the lower the absorption. One person, for example, will pass carmine used as a marker 12 hours after taking it by mouth, and another eating a similar diet will not pass it for 3 or 4 days. This transit time is reduced by increasing the amount of " roughage " or unavailable carbohydrate in the diet, but the person who passes the marker slowly on a low-roughage diet will also pass it more slowly than the average on a high-roughage diet. Babies show this individuality right from the time of birth. For example, one breast-fed baby passed his marker after 6 hours when he was 6 days old and 8 hours when he was 10 days old, while for another breast-fed baby the corresponding times were 24 and 28 hours.

What about urinary excretion? It is well known that the amount of calcium excreted in the urine varies a great deal from one person to another, but the amount excreted in the urine obviously follows intestinal absorption, and variations in urine calcium are largely the result of variations in absorption. In children there is another variable, the deposition of calcium in the bones. Between birth and adult life about 1,200 grams of calcium must be retained. We know that calcium is not laid down at a constant rate throughout the growth period, and variations in the rate of deposition of calcium in the bones from time to time are undoubtedly the reason for changes in absorption, and for the lack of correlation between children's absorption and urinary excretion of calcium that have been reported. I think that it is intestinal absorption that varies from one person to another, and the kidney simply performs its proper function of regulating the constancy of the internal environment.

How far nutritional characteristics are inherited I do not know. It would be interesting to know whether " good " and " bad " absorbers run in families. We do know that emotional upsets hinder the absorption of calcium, and probably of other dietary constituents as well. This may be because they hasten the passage of material through the gut and increase the amount of digestive juices lost in the faeces. Emotional disturbances also increase the metabolic rate, and therefore the calorie requirements. We have no idea how much variations in emotional stability from one person to another account for variations in their requirements for calories and nutrients, but it is quite clear that if we want to make the most of our food we must keep calm and not worry.

Nutritional individuality as regards calorie requirements and

ability to absorb nutrients from the intestine has important practical applications. All may be well in time of plenty, when there is an ample supply of good food and money to buy it, but in times of food shortage and famine the person with the high energy requirement and the one who is a poor absorber must come off badly, and rations which are quite adequate for some may be completely inadequate for others. It is well known that deficiency diseases often appear in some members of the population long before they do in others. In the old days, for example, some children (but never all of them) in a community got rickets. Some people get hunger oedema when food is short, and others do not. Some people get beriberi when rations are low in thiamine, while others show no signs of deficiency. Sir Rudolph Peters has drawn my attention to the fact that in his experiments published in 1928 (on the production of beriberi in pigeons by feeding them a diet of polished rice) each bird had its own characteristic way of reacting to this diet. Whereas one bird regularly developed symptoms of beriberi after 14 days on the diet, another showed no symptoms until after it had lived on the diet for 27 or 28 days, so man is not the only animal that shows these individual variations. Finally, this wide variation from one person to another in energy intake and expenditure, and in the ability to absorb nutrients from the intestine, makes it futile to give one single figure for requirement. The only reasonable way of setting out dietary requirements is to give a range, and the range must be wide. We do not all need the same amount of food, and we must face up to it. It has been faced before, for when the manna appeared the children of Israel were instructed: " gather of it every man according to his eating ".

DISCUSSION

Question: I have been very impressed over the years by the amount of clothes, especially bedclothes, used by people, and I have often thought that it may have something to do with their calorie requirement, and also their obesity. I wonder if Dr Widdowson has done any work on this, and whether she thinks it worth while working on in the future?

Dr Widdowson: Someone raised the same question at one of our postgraduate courses, saying that he and his wife couldn't agree