

Energy—requirements, intake and balance

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For any population group the requirements for energy from the diet depend upon many factors, the principal ones being physical activity, body size, and body build or body composition. The importance and interaction of these three factors is complex enough in a young adult population; in the elderly, their significance is even more complicated. For example, in young or middle-aged adults, the influence of physical activity can be allowed for very effectively by the occupation of the individual because, for most people, physical exercise during leisure time is relatively unimportant in increasing energy output (Durnin, 1966). Therefore it is usually necessary simply to consider the physical effort needed in the person's job. With elderly people, on the other hand, physical activity is affected by things other than occupation. For most elderly folk living in this and in similar countries, a full-time occupation is not common and even part-time work may be done only for a few years. Leisure is their full-time occupation and, while many fit elderly people are active, perhaps not many of the elderly are fit. There is certainly less necessity to do tasks and less inclination to undertake pursuits which use up energy in large quantities. Disease and disability also affect the amount of exercise taken. Disability, to a variable extent—particularly, in this climate, in the form of degenerative and metabolic disorders of bones, joints, tendons and muscles, giving rise to all the varied forms of 'rheumatism'—inevitably reduces the amount of physical activity. In a few instances, where disability is present without pain, as in hemiplegia or in deformations of bones, any exercise which is taken by, for instance, walking, will entail larger expenditures of energy than normal (Bard, 1963; Hirschberg & Ralston, 1965; Molbech, 1966; Müller & Hettinger, 1952). Physical activity will therefore tend to be very variable, particularly in the first decade of 'being elderly', that is 65 to 74 years, and many men and probably not so many women will be very active, but they are likely to constitute only a small fraction of the total population. Over the age of 75, while many of us know exceptional individuals of great activity—a Scottish farmer and a Swiss peasant, in our own experience, both aged 80, and both expending well over 3000 kcal/day (Durnin & Passmore, 1967)—these are rare and energy requirements are low for almost everyone of that age.

Body size and body build may also modify energy needs, but probably to a less extent than in younger people. Body size can be represented by body-weight, which is an important determinant of an individual's energy expenditure in a standard task (e.g. walking at a fixed speed); however, there may not be much effect exerted by weight on the total daily energy expenditure and indeed the correlation coefficient between weight and daily energy expenditure is not high ('r' about +0.4).

Body build, or body composition, may have something to do with the poor relationship of body-weight and total energy output. It is possible that the reason why heavier people do not always expend more energy than lighter people is that they are often heavier because they are fatter. There is no evidence available in this

country on large groups of elderly people where body-weight and body fat have been measured (although these are both very simple measurements to make). However, if heavier people are fatter, this may easily affect energy output since there are several published reports which suggest that fat people are less physically active than lean individuals (Chirico & Stunkard, 1960; Mayer & Bullen, 1964; Durnin, 1966).

With the above qualifications in mind, it is possible to set some standards of energy requirements for elderly men and women. Assuming that these values apply to persons who, if they are working at all, are not employed in moderately active or very active occupations, and where the average weight of the men is about 65 kg and of the women about 55 kg, we might suggest values as shown in Table 1 under the column 'UK'.

Table 1. *Recommended daily allowances for calories*

	Age	UK	FAO (1957)	National Research Council (1964)
Men	65-74	2350	2100	2200
	75+	2100	2100	2000
Women	55-64	2050	1850	} 1600
	65-74	2050	1600	
	75+	1900	1600	< 1500

These recommended values are somewhat higher than those suggested by the FAO (1957) and the US National Academy of Sciences (National Research Council, 1964). For men, aged between 65 and 74, their recommendations are, respectively, 2100 and 2200 kcal/day. The FAO think that no further reduction should occur for the 'over 75' group but the NRC value becomes reduced to about 2000 kcal/day. For women, the FAO suggests about 1850 kcal/day for age 55-64 and about 1600 kcal/day for 65-74 and older; the NRC values for these ages are 1600 kcal/day for the 20 year span 55-74, with a further reduction to less than 1500 kcal/day after the age of 75.

While all of the values shown in Table 1 are only recommendations and are meant to apply to groups and not individuals, yet clearly it is extremely important to take great care in the acceptance, however qualified, of one particular set of values since the findings by field studies on elderly people, when applied to these various standards, can make the nutritional intake of the elderly appear more than adequate, just sufficient or perhaps showing considerable undernutrition. For example, if the NRC suggestions were to form our standard, almost every survey on elderly women in this country (two examples of which are given in Table 2) would show that their intake of food was markedly in excess of their apparent needs. Whereas our own standards for the UK might tend to suggest that, for men, some degree of undernutrition was relatively common (Table 2).

This problem of deciding to apply a fixed scale of allowances has clearly some political importance. Some Government ministries might well be expected to act to improve the nutritional status of elderly people if it seemed that large enough

Table 2. *Some examples of food intake by the elderly*

Group studied		kcal/day	Reference
Women	Mean age: 64	1940	Durnin <i>et al.</i> (1957)
			Durnin <i>et al.</i> (1961)
	72	2070	Exton-Smith & Stanton (1965)
	76	1870	Exton-Smith & Stanton (1965)
Men	Mean age: 73	2050	Durnin (1966)
		70	2140

numbers were receiving insufficient quantities of food, through one cause or another—lack of money, lack of incentive for cooking meals, etc. Indeed, my impression would be that there are certain pressures being exerted at the present time to suggest that undernutrition is a relatively severe problem among the elderly in this country. The situation is made even more indeterminate since frank signs of malnutrition are only infrequently seen in elderly patients (Anderson, 1968) and it is sometimes suggested that the malnutrition is of a subclinical nature. In these circumstances, a simple reliance on results of food intake or of signs of nutritional deficiencies are not likely to provide more than uncertain indications to acceptable requirements of energy for the elderly. It seems to me that extra information is needed which will give reasonably precise information on the relationship between diet and changes in body composition in the elderly. These changes will be particularly concerned with tissue wastage, especially in muscle mass. The studies will probably need to be longitudinal in nature and may take many years, but the knowledge required from them is critical for solving the problem of adequate levels of calorie intake in the elderly. I do not think that animal studies will be of any great help—man, especially elderly man, is too variable, and too dissimilar to any convenient laboratory animal in his feeding, social and physical characteristics.

It would be very instructive to know whether the reduced muscle and tissue mass which seems to occur with ageing in later life is affected by diet; it is just conceivable that an ample food intake with adequate quantities of protein might retard somewhat this progressive wasting. In this context, it has been suggested to me (D. S. Miller & P. R. Payne, private communication) that some of the recommended allowances for elderly people will not provide sufficient calories to allow the protein of the diet to be used for tissue repair and maintenance: that is, no matter how rich in protein is the diet, the low total calorific level of the food eaten will mean that all or most of the protein will be required for energy. Miller & Payne think that the minimum amount of calories to provide the net protein requirement is about 2100/day for men (65 kg), and for women (55 kg) about 1700/day. It is possible that elderly people, perhaps because of decreased efficiency of the tissue and metabolic processes in general, require rather more than minimal quantities so that, by these standards, the NRC recommendations for women are perhaps too low. On the other hand, most of the evidence for these net protein requirements is based on studies on the growing rat and the results may not pertain precisely to a state of maintenance in elderly man.

While it may be beneficial to maintain the muscle mass of the body during middle

and old age, reduction in the fat content of the body seems to be entirely physiological. There have not been many published reports of the body composition of elderly people (Behnke, 1963; Krzywicki & Chinn, 1967; Montoye, Epstein & Kjelsberg, 1965; Parizkova & Eiselt, 1966; Young, Blondin, Tensuan & Fryer, 1963), but one of them (Montoye *et al.* 1965) shows that there is quite a marked increase in the number of lean people in the population after the age of about 60 years for men and about 67 for women. This could mean either that people become less fat after those ages or that only the less fat survive.

We need much more information on all aspects of nutrition in the elderly—changing body composition, protein requirements, requirements for calories, minerals and vitamins. Much work is needed and the problems become larger each year. It is surely the province of organizations with appropriate funds at their disposal, to encourage research into the elucidation of these problems. I see little evidence that such funds are being given for nutritional studies among the elderly—all the more strange since senescence is so obviously present in some of the controlling committees.

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Protein status of the elderly

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I propose to approach this question from the point of view of the epidemiologist and would say at once that I do not believe the necessary basic research has yet been done to enable the borderline between adequate and inadequate protein status