Editorial

The extent to which individuals can or do adapt their metabolism to changes in diet, or alternatively their dietary intake to predetermined physiological changes (for example, pregnancy) is of central importance in nutrition research. In this issue, we publish a significant paper addressing an important aspect of adaptation, namely the energy needs of pregnancy. Prentice *et al.* (1989) addressed the hypothesis that in pregnancy a reduction in metabolism can be of sufficient magnitude to spare the entire maintenance energy costs of the fetus and other products of conception and conclude that a highly significant depression of metabolism occurred in two out of the eight women, and a smaller depression in three others studied up to 24 weeks gestation in support of the initial hypothesis.

The importance of nutritional adaptation and our lack of understanding of it become apparent when we try to evaluate the results of balance studies as part of the assessment of nutrient requirements as described recently by Dr Whitehead (Whitehead, 1989). Those who are sceptical or downright dismissive of the value of balance studies point to the phenomenon of adaptation. They argue that if adaptation is common and most people are able to achieve it, then studies of short duration will give an erroneous measure of requirements since individuals will not have had time to adapt to the new level of intake being imposed. Most studies have been of this type.

Understanding nutritional adaptation and a person's capacity for it is also relevant to the formulation of dietary guidelines for populations. Such measures are taken because of perceived associations between the consumption of high levels of certain food components and the prevalence of some degenerative diseases. The more prevalent the capacity for adaptation, the less significant may such perceived hazards be.

In attempting to investigate the phenomenon, the first question is surely, what do we mean by adaptation? It is clear from reading the proceedings of the Rank Prize Funds Symposium devoted entirely to this topic (Blaxter & Waterlow, 1985) that a definition is by no means simple. Nutritional adaptation is clearly part of a more general phenomenon of physiological adaptation and should be distinguished from the Darwinian process of genetic adaptation (which may determine an individual's capacity for physiological adaptation) and the phenomenon of social adaptation (which may be based on the needs determined by physiological adaptation). Adaptation serves to preserve a function (e.g. the development of a fetus) in the face of environmental conditions that might not otherwise allow that function to proceed 'normally'. It is implied that the adapted state can be maintained for an extended period, can be reversed and that there is a 'preferred range' of values within which the adapted state can operate 'satisfactorily'.

In nutrition, the 'preferred ranges' are likely to be within broader limits and those limits will be less well-defined than in classical physiological functions such as body temperature, blood pH, etc. Waterlow (1985) distinguishes between an adaptation as defined above and a 'response'. Thus, the stunting in stature of some Third World children, which some regard as a beneficial adaptation that enables them to survive on smaller amounts of food, Waterlow regards as a 'response' to a particular environment. It might not be a 'satisfactory' response in that such children have a small maximum working capacity but a value judgement has to be made. Adaptation should be reserved for phenomena in which it is possible, eventually, to define specific biological mechanisms without the need to make value judgements.

The next question of relevance to the research worker in this field is to what extent do individuals differ, one from another, at any one time or does one person's metabolism change over a period of time in a manner that is not apparently in response to a defined stimulus? This will determine our interpretation about whether they have indeed 'adapted' or whether our measurements have simply identified the phenomenon of individual variation. (The extent to which individuals differ in their capacity to adapt to a particular change is also an important, but different, question.)

In a famous study, Malm (1958) described how some men adapted their calcium balance to a large reduction in Ca intake while others apparently did not. Some adapted quickly, some needed a very long time; some even appeared to adapt initially, then entered a phase of negative balance only to revert to an adapted state again later. Malm judged that environmental and emotional factors could, in some individuals, have had a large influence on their apparent capacity to adapt.

Returning to energy metabolism, de Boer *et al.* (1985) measured 24 h energy expenditure (whole body indirect calorimetry) of ten young women over three consecutive days. They repeated the measurements between 2 and 24 months later. Energy expenditure did not differ systematically between the consecutive days and although the mean energy expenditure of the group did not differ between the first and second periods, one woman's energy expenditure decreased by 11·8% while another's increased by 5·8%.

The study of Prentice and colleagues is characterized by measurements of great precision so that 'measurement noise' is unlikely to have obscured changes that might be interpreted as adaptive. This study is also important in that it follows the same women from a pre-pregnant baseline over a period of 36 weeks gestation. Previous studies have tended to be cross-sectional and, therefore, inadequate to provide evidence for adaptation. Prentice *et al.* show that, whereas the group average 24 h energy expenditure showed no change during the first 18 weeks gestation, two individuals exhibited statistically significant depressions in energy expenditure during the first 18 weeks and three others showed smaller reductions. It is these reductions that the authors interpret as evidence for adaptive changes to spare energy for fetal development. It is particularly interesting that women displaying these energy depressions tended to be thin, suggesting that changes in metabolism might be responsive to initial energy status.

No subject in this study, however, exhibited changes from the baseline pre-pregnancy measurement of more than 10%. In the de Boer study discussed earlier, differences for non-pregnant women between the first measurement and the second, 2–24 months later, could be as high as 11·8%. It would only have needed subjects 1 and 4 in the Prentice study to have had initial values 5% less and subjects 3 and 5 values 5% greater for there to have been no observable deviation of energy expenditure in any of these subjects. Such differences might occur as a result of unidentified or uncontrolled environmental or psychological factors. A control group of similar non-pregnant women studied over the same time period or the same women studied over a similar period of time in the non-pregnant state would have helped to resolve this slight worry.

These are criticisms, however, made from the luxury of an arm-chair. Such controlled experiments are demanding on resources in time, money and staff. Given the trends towards reduction in research funding and the pressures to publish, it is unlikely that any research group can contemplate such expenditures. It is unfortunate that these pressures exist at a time when nutrition research needs more than ever to be concerned with well-controlled human studies of sufficiently large groups of subjects, spanning considerable periods of time.

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REFERENCES

Blaxter, K. & Waterlow, J. C. [editors] (1985). *Nutritional Adaptation in Man*. London: John Libbey.

de Boer, J. O. (1985). Energy requirements of lean and overweight women, assessed by indirect calorimetry. PhD Thesis, Wageningen University, The Netherlands.

Malm, O. J. (1958). *Calcium Requirement and Adaptation in Adult Men*. Oslo: Oslo University Press.

Prentice, A. M. Goldberg, G. R., Murgatroyd, P. R., Davies, H. L. & Scott, W. (1989). Energy-sparing adaptations in human pregnancy assessed by whole-body calorimetry. *British Journal of Nutrition* **62**, 5–22.

Waterlow, J. C. (1985). What do we mean by adaptation? In *Nutritional Adaptation in Man*, pp. 1–11 [K. Blaxter and J. C. Waterlow, editors]. London: John Libbey.

Whitehead, R. G. (1989). Editorial. *British Journal of Nutrition* **61**, 123–124.

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