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ASSESSMENT OF THE ENERGY VALUE OF HUMAN AND ANIMAL FOODS

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Chairman's Opening Remarks

By R. C. GARRY, *Institute of Physiology, University of Glasgow*

When the majority of workers accept uncritically theories hallowed by use and wont, and know little of the experimental bases on which their practices rest, then a review can be of the greatest value. Such is the position with 'Assessment of the energy value of human and animal foods'. The authorities of the past did make a distinction between *Brennwert* and *Nährwert* of foodstuffs but it is to be doubted if the majority had an inkling of the complexities of the most trivial of the biological functions involved in nutrition.

In physical science machine-like models have their uses. In biological science they are dangerous unless they are recognized for what they may be, useful simplifications. To argue that the operation of a machine, which can carry out some task also performed by living creatures, necessarily explains the living process is a *non sequitur*. To talk of food as 'fuel' for the living 'machine' is a useful metaphor but, if that usage calls up the picture of an internal combustion engine, the over-simplification is dangerous. Food has to build and repair and maintain the fabric of the machine as well as to supply energy for external work. Moreover, the body 'processes' its 'fuel' in digestion, in absorption and in metabolism.

The energy value of a food cannot be studied in isolation from other dietary factors. The mineral content, the vitamin content, toxic elements, may all affect the energy value of food by influencing the well-being of the animal. In addition, the age of the animal, and its past dietetic history inevitably affect the immediate fate of the food ingested. The animal may be storing energy or drawing upon reserves. It may be growing, it may be lactating. Human beings are in a very special category. The value of a food for a man cannot be assessed unless we know the environmental and racial history of the community to which he belongs. Social habit, beliefs, and prejudices may all play a part.

Animals differ. The ruminant can derive energy from food without value to the carnivore. Are we so sure that less obvious differences do not exist between animals

of the same species? Two world wars have forced us to think of human beings and of farm animals as populations in a statistical sense. We count heads, assign 'man values' for energy requirements. Such a practice is essential for the administrator, but it does ignore individual differences. We have no evidence for variation in the efficiency of the fundamental biochemical processes with which individuals of the same species liberate energy from food. Yet human beings, as individuals, do differ in their instinctive demand for food. This difference is not necessarily correlated with the expenditure of energy. The obese human being within the nation is an inefficient individual. But the ox, fattening in his stall, is fulfilling his man-made destiny.

The assessment of the energy value of human and animal foods cannot then be studied as a problem in pure chemistry. In due time biochemistry will elucidate the complexities of the processes at molecular and cellular level which determine the liberation of energy from food. But the final word is with the living animal itself which is a biological entity. And a human being is also a person.

Methods of Assessing the Energy Values of Foods for Ruminant Animals

By K. L. BLAXTER and N. McC. GRAHAM, *Hannah Dairy Research Institute, Kirkhill, Ayr*

The evaluation of animal feeding-stuffs has advanced in three major steps from the empirical and traditional knowledge contained in writings which, in this country, go back to the 16th century. Immense progress was made when, in 1809, Thaer introduced his system of evaluation based partly on chemical analyses of feeding-stuffs carried out by Einhov and partly on the results of practical tests in which feeds were compared with a standard hay (Thaer, 1809, 1810, 1812, 1837, 1880). These 'hay values' were modified by Boussingault (1839), Liebig (1842), Grouven (1858) and others as information about the crude chemical composition of food accrued, and this knowledge led eventually to attempts to express requirements in terms of the protein, fat, carbohydrate and woody fibre the food contained (Wolff, 1895). Thus the comparative aspect of Thaer's original system, containing as it did the elements of a biological assay, was lost and this approach did not again receive the attention it merited till the development of the food unit in Scandinavia by Winkel in 1880, by Svendsen in 1896 and by Fjord in 1898 (see Eskedal, 1954; Hansson, 1916).

With recognition of the fact that part of the feed energy is rejected by the animal in faeces and urine came the second advance in the introduction by Henneberg (1860) and by Wolff (1895) of the 'digestible nutrient' estimation which allowed for losses in the visible excreta. Their work led to assessment of the value of feeds in terms of total digestible nutrients, usually called T.D.N., (Atwater, 1874–5, 1890; Hills, 1900; Hills, Jones & Benedict, 1910; Woll & Humphrey, 1910) and