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MEDICAL LABORATORY SCIENCE

Question

1. WHAT DO YOU UNDERSTAND BY THE TERM "BIOLOGICAL VALUE OF PROTEINS"
2. LIST AND EXPLAIN THE VARIOUS METHODS OF ASSESSMENT OF PROTEIN QUALITY.

The biological value (BV) of a protein is an expression of a number of the nutritional characteristics of the food. These include (1) the digestibility, (2) the availability of the digested products, and (3) the presence and amounts of the various essential amino acids. ological Value of Proteins

The biological value of a protin has traditionally been defined on the basis of
its amino-acid content in relation to human requirements and the suitability for
digestion, absorption and incorporation into body proteins. The biological value can be calculated by determining the nitrogen of the food intake minus the urinary and fecal nitrogen excretions by the formula:

$$Bv = \frac{\text{dietary N} - (\text{urinary N} + \text{Fecal N})}{\text{Dietary N} - \text{fecal N}} * 100$$

2.
3. A. The PDCAAS, which was introduced by the Food and Agriculture Organization of the World Health Organization (FAO/

WHO) in 1991, is the current internationally approved method for protein quality assessment . Briefly, PDCAAS is based on the combination of an age-related amino acid reference pattern that is representative of human requirements plus estimates of the digestibility of the protein. The amount of potentially limiting amino acids in the test protein is compared with their respective content in the appropriate reference pattern, identifying the single most limiting amino acid that determines the amino acid score.

B. Net Protein Ration (NPR)

A major criticism of the PER has been that it does not take into account the protein required for maintenance since only gain in weight is used in the calculation. Bender and Doell (36) suggested that this criticism could be avoided by the inclusion in each test of a group of animals fed a protein-free diet. Net Protein Ratio (NPR) was then calculated as the overall difference in gain (gain in weight of the test group plus loss in weight of the protein-free group) divided by the protein eaten. It is apparent that if body composition is constant, this procedure is identical to NPU except that it is expressed in arbitrary units which are less useful than the percentage of protein utilized. The weaknesses are, of

course, identical with those discussed under NPU.

Relative Nutritive Value (RNV)

Hegsted et al. (34, 37, 38, 39) proposed a slope-ratio assay using rats in which the slope of the regression line relating body protein (or body water) of a standard protein (egg protein or lactalbumin) assumed to have maximal nutritive value was compared to that of the test protein. The tacit assumption made in the measurement of NPU or BV that these values are independent of the level of protein fed is thus tested in this procedure. As in the calculation of NPU and BV the original assumption was made that the regression line should bisect the Y axis at the

point defined by the group fed the protein-free diet. As has already been discussed above, this often and perhaps, usually, does not happen. The regression lines above the maintenance level of intake are, however, linear over a substantial range of intakes with young growing rats (40) contrary to the conclusions of Miller and Payne (28). In young growing rats where maintenance requirements are relatively small compared to the growth requirements, this method is probably the most logically defensible of the assays available as an estimate of the protein quality for growth. The important question remains as to whether estimates of protein quality for growth in young rats are adequate

estimates of quality for man including those of the young infant. Presumably, many proteins will be more efficiently utilized in human beings than they are for young growing rats.

C Nitrogen Balance Index

Allison and Anderson (41) showed, as has been discussed above, that Biological Value is the slope of the regression line relating nitrogen balance and nitrogen intake and suggested that this might have certain advantages in practice over the usual method of determining BV. The concept of this index is rather similar to Relative Nutritive Value discussed above. Since it is becoming increasingly clear that nitrogen retention is not linearly related to nitrogen intake

in the region of intake below maintenance, the validity of this index requires confirmation.

D Tissue Regeneration

A variety of techniques involving the recovery of weight or of specific tissues after protein depletion have been proposed (42, 43, 44, 45). The specific merits of such assays as opposed to weight gain of young rats, for example, remain to be demonstrated