Harry okure

BCH 204

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Pharmacology

1.)

Biological value (BV) is a measure of the proportion of absorbed protein from a food which becomes incorporated into the proteins of the organism's body. It captures how readily the digested protein can be used in protein synthesis in the cells of the organism. Proteins are the major source of nitrogen in food. BV assumes protein is the only source of nitrogen and measures the proportion of this nitrogen absorbed by the body which is then excreted. The remainder must have been incorporated into the proteins of the organisms body. A ratio of nitrogen incorporated into the body over nitrogen absorbed gives a measure of protein "usability" – the BV.

BV uses two similar scales:

1. The true percentage utilization (usually shown with a percent symbol).

2. The percentage utilization relative to a readily utilizable protein source, often egg (usually shown as unitless).

These two values will be similar but not identical.

The BV of a food varies greatly, and depends on a wide variety of factors. In particular the BV value of a food varies depending on its preparation and the recent diet of the organism. This makes reliable determination of BV difficult and of limited use fasting prior to testing is universally required in order to ascertain reliable figures.

BV is commonly used in nutrition science in many mammalian organisms, and is a relevant measure in humans.It is a popular guideline in bodybuilding in protein choice.

2.)

Biological Value (BV)

Net Protein Utilization (NPU)

Amino Acid Score

Protein Efficiency Ratio (PER

Net Protein Ration (NPR)

Tissue Regeneration

Microbiological Assays

Biological Value (BV)

Biological value, as defined by Thomas and Mitchell has long been considered the method of choice for estimating the nutritive value of proteins. It has been defined as the "percentage of absorbed nitrogen retained in the body" and a complete evaluation of the dietary protein includes measurement of the Biological Value and the Digestibility. These values are obtained by measuring the fecal and urinary nitrogen when the test protein is fed and correcting for the amounts excreted when a nitrogen-free diet is fed. True digestibility is defined as the percentage of food nitrogen absorbed from the gut

Net Protein Utilization (NPU)

Like Biological Value, NPU estimates nitrogen retention but in this case by determining the difference between the body nitrogen content of animals fed no protein and those fed a test protein. This value divided by the amount of protein consumed is the NPU which is defined as the "percentage of the dietary protein retained". These conditions were chosen empirically and the particular merits of these conditions remain to be demonstrated. Since in young animals there is a high correlation between body nitrogen and body water content,the substitution of body water measurements for body nitrogen measurements has been widely used. Indeed, measurement of body water may be more accurate than measurement of body nitrogen because sampling errors are eliminated; also, it is much more convenient and less expensive.

Amino Acid Score

since all amino acids must be present at the site of protein synthesis in adequate amounts if protein synthesis is to proceed, a comparable deficit of any amino acid would limit protein synthesis to the same degree. Thus, they suggested that if the composition of an "ideal protein" was known, i.e., a protein which contained every essential amino acid in sufficient amounts to meet requirements without any excess, then it should be possible to compute the nutritive value of a protein by calculating the deficit of each essential amino acid in the test protein from the amount in the "ideal protein". The "most limiting amino acid", the one in greatest deficit, would presumably determine the nutritive value.

Protein Efficiency Ratio (PER)

Protein Efficiency Ratio (PER) has been the method most widely used because of its simplicity. Osborne observed that young rats fed certain proteins gained little weight and ate little protein whereas those which were fed better quality proteins gained more weight and consumed more protein. In an attempt to compensate for the difference in food intake, they calculated the gain in weight per gram of protein eaten and this has been called PER. It is known that the PER for any protein is dependent upon the amount of protein incorporated in the test diet. Standardized conditions have therefore been proposed.These include the use of 10 weanling rats per test group, diets containing 9.09% protein (N × 6.25), a test period of 4 weeks' duration, and that each experiment include a group which receives standardized casein. The PER is calculated as the average total weight gain divided by the average grams of protein consumed. Since PER in various laboratories was not constant for the same protein,

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. 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.

Tissue Regeneration

A variety of techniques involving the recovery of weight or of specific tissues after protein depletion have been proposed. The specific merits of such assays as opposed to weight gain of young rats.

Microbiological Assays

Many micro-organisms require the essential amino acids required by monogastric animals. If it were possible to find organisms which required not only the same pattern of amino acids but in the same relative amounts, their growth response when supplied with limited amounts of various proteins or protein hydrolysates would provide a simple and efficient assay of nutritive value. Considerable effort has been directed toward this and it is clear that the responses of some organisms resemble those observed with some of the rat assays described. The difficulties are clear, however, since the limitations in the animal assays mean that they provide an inadequate base for comparison with assays of this kin