18/MHS07/022

BCH 204

PHARMACOLOGY

ASSIGNMENT:

1. WHAT DO YOU UNDERSTAND BY THE TERM ''BIOLOGICAL VALUE OF PROTEINS"

2. LIST AND EXPLAIN THE VARIOUS METHODS OF ASSESSMENT OF PROTEIN QUALITY.

ANSWER:

**Biological value** (**BV**) is a measure of the proportion of absorbed [protein](https://en.wikipedia.org/wiki/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](https://en.wikipedia.org/wiki/Protein_biosynthesis) in the [cells](https://en.wikipedia.org/wiki/Cell_(biology)) of the organism. Proteins are the major source of [nitrogen](https://en.wikipedia.org/wiki/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 organism’s body. A [ratio](https://en.wikipedia.org/wiki/Ratio) of nitrogen incorporated into the body over nitrogen absorbed gives a measure of protein "usability" – the BV.

Unlike some measures of protein usability, biological value does not take into account how readily the protein can be [digested](https://en.wikipedia.org/wiki/Digestion) and absorbed (largely by the [small intestine](https://en.wikipedia.org/wiki/Small_intestine)). This is reflected in the experimental methods used to determine 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](https://en.wikipedia.org/wiki/Egg_(food)) (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

Methods of Estimating Protein Quality

Methods of Estimating Protein Quality.

* Biological Value (BV)
* Net Protein Utilization (NPU)
* Amino Acid Score.
* Critique.
* Other Methods of Estimating Protein Quality.
* Protein Efficiency Ratio (PER)
* Net Protein Ration (NPR)

Net Protein Utilization (NPU)

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". Miller (12) proposed a procedure which involved replicate groups of 4 weanling rats housed in group cages which were fed either the "protein-free" or the "test" diet for 10 days. 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 (13-16), 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

Block and Mitchell (17) originally proposed that 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 in practice they suggested the protein in whole egg as the "ideal" since this was known to have a Biological Value closely approaching 100. They recognized that egg proteins might contain some amino acids in excess of requirements. If so, deficits of these in other proteins calculated by this procedure would be misleadingly high. That is, the calculated nutritive value would be lower than it actually was. However, Block and Mitchell (17) compared Biological Values which were thought to have been accurately estimated and with "amino acid deficits" calculated using egg protein as the standard found a rather high correlation (r = .86)..

Critique

, the use of estimates of protein quality to calculate the amount of protein needed to meet requirements when different diets are consumed requires that the estimate of quality vary in some known fashion, preferably in linear fashion, from zero to 100% utilization. Actually, when Block and Mitchell (17) first proposed the use of Amino Acid Scores, they found that Biological Value did not follow the predicted relationship with Amino Acid Score. Rather, the regression line relating BV and Amino Acid Score indicated that proteins completely lacking an essential amino acid and which would therefore have an Amino Acid Score of zero would apparently yield a BV of approximately 25% This would mean that the requirement could be met with such proteins if they were fed at a level providing four times the estimated minimal protein requirement. This presumably cannot be true since it would imply that the protein needs could be met without a supply of all of the essential amino acids.

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...