Taurine: Portrait of an Amino Acid

I. Introduction

In a society that idolizes youth, health and energy but often desires those treasures in the form of a “quick fix,” medicine and science are inundating popular culture. Men’s and women’s magazines tout the potential health, beauty and weight loss benefits of supplements while celebrities endorse the latest fad diet.

GNC sells one such supplement, Taurine, in 500mg tablets, claiming it will improve a variety of ailments – congestive heart failure, cystic fibrosis, anemia, epilepsy, and type II diabetes (just to name a few). Besides being available in a tablet form it is added to protein powders, dog and cat food, baby formula, and energy drinks. So what is it, exactly?

II. Amino Acid

Taurine is a conditional, or non-essential, amino acid found in meat, fish, and breast milk (Zeratsky 2012). In order to define the taurine, we must know what amino acids are.

Amino acids are the substances, or building blocks, which form proteins. These proteins then take on various functions. Enzymes catalyze (accelerate) nearly every metabolic reaction within the body, such as peptin which breaks down certain components of food during digestion; antibodies are utilized by the immune system to defend the body from illness; contractile proteins, such as myosin, facilitate movement; and hormones, like insulin, act as the ultimate “cruise directors,” coordinating communication and activities throughout the body.
Amino acids all have the same basic structure. Carbon is always the central part of an amino acid. There are four different chemical groups connecting to the carbon (as Picture 1 indicates): an amino group (-NH$_3$), a carboxyl group (-COOH), hydrogen (-H), and a random chemical group (-R). The (-R) group determines the identity of the amino acid and varies from one type to another. For example, the (-R) group for methionine (Picture 2) is -CH$_2$CH$_2$SCH$_3$ while the (-R) group for cysteine (Picture 3) is –CH$_2$SH.

There are twenty different kinds of amino acids in the world. Among these, twelve can be produced by the human body. These twelve are called “non-essential amino acids.” The other eight, however, cannot be manufactured by the human body and are referred to as “essential amino acids” because humans must obtain them from the food they consume in daily life.
III. Taurine

According to Taber’s Cyclopedic Medical Dictionary, Taurine is “a colorless crystalline acid (C₂H₇NO₃S) that is synthesized in the body from cysteine and methionine, is similar to amino acids but is not a component of proteins, and is involved in various physiological functions (as bile acid conjugation and cell membrane stabilization).” It is generally considered one of the conditional amino acids because it can be manufactured in the liver under certain dietary constraints. More specifically, it is synthesized from cysteine and methionine with the aid of Vitamin B6. Taurine was first extracted from ox bile, thus receiving its name from the Latin *taurus*.

Taurine may also be obtained from the diet, as it is found in eggs, meat and seafood (pg. 57 2008). Deficiencies of this nutrient have been linked to epilepsy, macular degeneration (loss of vision in the center of the field of vision; usually age related) and migraines. Though taurine is not a true amino acid (strictly speaking), it *is* regarded as an essential amino acid when it comes to infants. Because they are not yet able to produce it endogenously (within their own bodies), and it is imperative to brain development, newborns receive taurine from the mother’s breast milk or fortified infant formula. It is added to mass-manufactured pet food as the content of meat is reduced.

A. Physical Properties of Taurine

To specifically define a kind of substance, both physical and chemical properties must be considered. Physical properties are those which can be expressed by the substances without going through the chemical reactions. For example, color, smell, melting point (the temperature at which a solid melts), solubility in liquid and density are physical properties.
Taurine is a kind of crystal with color variations from colorless to white. Its boiling point is 305.11°C. It doesn’t have any smell, though if tasted, it would be a little sour. Taurine will dissolve in water but not in alcohol or ether. The density of taurine is 1.734 g/cm³. As a comparison, the density of water is 1.00 g/cm³ and that of pure iron is 7.87 g/cm³. That means with the same volume of taurine, water and iron, taurine would be lighter than iron and heavier than water.

### B. Chemical Properties of Taurine

Chemical properties are the properties expressed in chemical changes. For instance, flammability (the property of a substance that determines whether or not it can burn), stability, and some special phenomena occurring in certain reactions are considered chemical properties.

Taurine’s chemical formula is C₂H₇NO₂S and its official name is “beta-amino-ethanesulfonic acid.” It’s not poisonous or flammable. It’s quite stable, which means the possibility of it reacting with the other substances is low. Taurine has molecular weight of 125.15. Every 1 mol (6.02*10²³ molecules) of taurine weighs 125.15 grams. Taurine doesn’t take part in the synthesis (or creation) of other proteins in our body.

### IV. Benefits in Daily Life

Taurine has many positive physiological effects. It has demonstrated incredible benefits in patients who suffer congestive heart failure, high blood pressure, liver diseases (such as hepatitis), seizure disorders, diabetes, and even alcoholism (web 2013). It is also purported to improve athletic and cognitive performance, enhancing vision and bolstering the immune system. Unfortunately, how taurine works to achieve these results is somewhat mysterious to
scientists. One theory is that because it calms the sympathetic nervous system (which responds to stress) it lowers blood pressure and improves cardiac health. In the athletic world, there is conflicting information. Most magazines and fitness experts point towards taurine’s antioxidant properties, but some claim it has the power to build muscle (which has yet to be proven in the medical community). Even less is known about the long term effects of taurine supplementation, fortification of foods and drinks, and heavy use.

V. Conclusion

Taurine is a conditionally essential amino acid. It can be produced by the human body, though it’s mainly acquired from the diet. Taurine is a very important substance for the human being. It has many functions but manufacturers of energy drinks may be adding it to their list of ingredients for its alleged abilities to enhance cognitive and athletic performance, a controversial issue that calls for further investigation.
REFERENCES


