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Review of the Clinical, Biochemical, and Metabolic Benefits

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Abstract

It is now understood that thiamin, generally known as vitamin B1, is essential for the metabolism of energy. It was found as a result of the initial research on the "anti-beriberi factor" present in rice polishing. It took years of investigation after its 1936 synthesis to determine how it worked to treat beriberi, a deadly disease that has been around for thousands of years, especially in societies where rice is a major food source. This article makes reference to the previously documented beriberi symptoms while highlighting how they are distinct from those of pure, experimentally generated thiamine deficiency in human beings. The potential relevance of thiamine deficiency in contemporary nutrition and some of its more peculiar symptoms are highlighted. Its pathophysiology and biochemistry are described, and some of the less frequent diseases linked to thiamine shortage are examined. The information that applies to complementary alternative medicine is developing quickly, and it is essential to grasp the role of thiamine in contemporary nutrition. References are provided that shed light on how this vitamin is used in clinical problems that aren't typically caused by nutritional deficiencies. The function of all thiamine and its artificial derivatives is addressed. Thiamine is essential for the metabolism of glucose. Thus, emphasis is focused on the idea that consuming too many simple carbs instantly raises the need for this vitamin.

Keywords: Biochemical; Clinical research; Metabolism; Nutrition; Vitamins

Introduction

Glycosphingolipids are a component of the glycocalyx that covers the surface of eukaryotic cells, along with glycoproteins and glycosaminoglycans. An important component of the cell surface glycans on neuronal cells is provided by gangliosides, sialic acid-containing glycosphingolipids. GSLs are lipids with one or more sugar residues and a sphingoid base. Acetylmannosamine and phosphoenolpyruvate are used in the biosynthesis of sialic acids, which are nine-carbon sugars. They are more acidic than other carboxylic acids and negatively charged at most physiological pH levels, with a typical value of about 2.6. The scientist gave the term "ganglioside" to a class of acidic GSLs that he isolated from ganglion cells and from the brains of individuals with what is known as amaurotic stupidity. Submaxillary mucin was the source of sialic acid's initial isolation in 1936. Kuhn and Wiegandt described the first ganglioside structure in 1963. Brain gangliosides were proposed to have a nomenclature by Svennerholm in 1962. In the 1960s, Sandhoff and others discovered the biochemical flaws behind the illnesses formerly known as amaurotic stupidity, GM1-gangliosidosis, Tay-Sachs, and Sandhoff disease [1-3].

Functional foods have historically been employed for medical purposes. Research on dietary supplements and functional foods for various disorders has gained popularity in recent years. One of the most often studied functional foods is turmeric. The Zingiberaceae family includes which is widely cultivated in Asia's tropical regions. Yellow root and turmeric root are two more names for turmeric that are widely used.

It typically grows to a height of 3 to 5 feet, has oblong leaves, and produces blooms with yellowish funnel shapes. At a temperature range of 20 to 35 °C and 1500 mm of rain per year, C. longa can be cultivated in a variety of climatic conditions. It thrives remarkably in soils that are well-drained, sandy or clay loam, pH 4.5–7.5, and have an excellent organic status [4].

The use of turmeric as a spice in Asian cuisines and other cuisines around the world has a long history. For instance, in Persian, it is referred to as Zard choobe. It increases the colour tone and flavour of dishes like rice, yoghurt, and poultry. Customers prefer to combine it with other spices, though, to enhance the flavour. With particular reference to China, India, Iran, and Indonesia, many cultures use turmeric and its different components to create various traditional medicines to treat human ills. For centuries, turmeric has been used as a tonic [5].

Materials and Methods

The study was submitted to the Bioethics Committee of the Medical University of Warsaw, which acknowledged the study's protocol and voiced no objections. The study complied with local laws regarding human studies and the use of human tissues and organs as well as the principles of the Declaration of Helsinki.

Six male donors, ranging in age from 44 to 61, provided the cadaver globe eyes, which were harvested 0-1/2 hours postmortem. Patients who had brain death that had been verified and was brought on by previous traumatic cerebrovascular damage underwent the operation at the hospital in Poland. Then, after being cut away from the eye globes, the corneas, irises, ciliary bodies, lenses, and retinas were immediately frozen and kept at 80°C. Donors did not have any systemic, ongoing illnesses or recent medication use. The samples were shipped on dry ice to Norway for the purpose of further research. The corresponding frozen tissues were promptly weighted, chopped into pieces of 2 mm by 2 mm by 1 mm, and then placed into the HR-MAS rotor before the analysis [6-8].

A Bruker Avance DRX600 spectrometer was used to conduct HR MAS 1H spectroscopy. It operated at 600.132 MHz for protons.

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In a zirconia 4 mm diameter HR-MAS rotor, tissue samples were submerged in water. As an internal shift reference, sodium 3′-trimethylsilylpropionate was used. In order to capture the spectra, a 4 mm 1H/13C MAS probe was used. The number of scans was 512, and the samples were rotated at 5000 Hz. A presaturation selective pulse was used to suppress the water [9].

Discussion

The magnetic characteristics of some atomic nuclei, such as protons, are taken advantage of by the scientific technique known as NMR spectroscopy. It establishes the molecular structures' physical and chemical characteristics. It is based on the phenomena of nuclear magnetic resonance and can offer comprehensive details about the molecules' structure, dynamics, reaction state, and chemical surroundings. In order to acquire information about a molecule's electronic structure and subsequently identify the biological substance, the intramolecular magnetic field around an atom in a molecule alters the resonance frequency. The in vivo experiments are limited to a few high-concentration metabolites due to the strength and intrinsic inhomogeneity of the magnetic fields. The bulk of the metabolites in the tissue can be separated and relatively quantified using ex vivo NMR spectroscopy of the excised tissue [10, 11].

When high resolution techniques and magic angle spinning which enable examination of intact samples, were initially utilised in NMR spectroscopy, the quality of tissue spectra significantly improved. Ordinary high resolution NMR spectroscopy of the removed tissue led to widening of the metabolite peaks in the NMR spectra because of the molecular restrictions of semisolids.

NMR spectroscopy is nondestructive, rather quick, and doesn't call for laborious sample preparation. Between being collected and being introduced to the NMR apparatus for measurements, the studied sample is solely subject to deep freezing. Potentially harmful consequences of this approach, particularly on sensitive metabolites, were avoided because an extraction is not required prior to examination using HR MAS NMR spectroscopy. The biochemical components of such frozen samples so accurately represented the corresponding in vivo levels [12-14].

The blood supply is thought to be the best method for delivering nutrients and removing waste items from any organ, including the eye. It also considerably reduces the likelihood that cells or tissues will spontaneously malfunction or suffer injury. The blood plasma may become more contaminated with harmful metabolites as a result of several chronic systemic disorders, which may, for example, harm the retina. Diabetes is one such instance; when the typical level of the innocuous molecule glucose is exceeded, metabolic changes result, which over the course of an extended observation period affect the retina's functionality. Additionally, even dietary errors could result in permanent harm; accidental methanol ingestion is the worst case scenario [15].

Aqueous humour, a transparent fluid generated from blood plasma, is another source of nutrition in the eye. Although the quantities of free amino acids in aqueous humour are almost identical to those in blood plasma, the amount of protein in aqueous humour in the anterior chamber is less than 1% of that in plasma. As proteins cause turbidity, turbidity scatters light, which reduces the optical effectiveness of the eye, it is important to ensure that possible antigens in the bloodstream are kept from reaching the eye tissues [16].

The cornea, with a strong metabolic activity in the epithelium and endothelium, is thought to be the most exterior aspect of the eye because to its location. It also serves as the primary physical barrier to external influences. The aqueous humour is the primary nutrient supply, but the tear film and limbal blood arteries also contribute some essential nutrients and oxygen to the cornea. The study by Redbrake et al. has shown that, despite the absence of a regular blood artery supply, the biochemistry of the cornea is nevertheless susceptible to the metabolic changes brought on by long-term illnesses or fatal causes. This discovery has recently been supported by a study that demonstrates significant biochemical differences between corneas taken from individuals with liver cirrhosis or cardiovascular disorders and corneas obtained from healthy donors [17].

The retina, as opposed to the cornea, is exceptional in that it has the highest oxygen consumption per unit weight of any human body tissue and that it has two distinct circulatory systems to support this metabolic demand. PCA showed some biochemical variations between the avascular and vascular eye tissues, but the cornea and retina were the most distinctively different. The distant grouping of corneal sample on the score plot was attributed to ATP, one of the PC1 molecules. High amounts of ATP in the corneas compared to the other tissues may be explained by the need for extra energy stores in the cells to protect the eye from external stressors and maintain the integrity of the corneal tissue.

Lactate, myoinositol, and taurine were the other PC1-score substances whose levels were considerably lower in the cornea samples than in the retina samples. Myoinositol and taurine are two examples of primary osmolytes. However, taurine has also been suggested to improve cell survival as a membrane stabiliser or an antioxidant, whilst myoinositol may further serve as a cellular signal transducer and play a vital part in growth and differentiation. Given that a sizable portion of the potentially harmful elements influencing the human eye are free radical species, the statistical differences may be explained by the increased metabolic turnover of these substances in corneas intended to shield the organ from harm [18-20].

Conflict of Interest

None

Acknowledgment

None

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