

## DIABETES: QUANTUM ANALYSIS OF THE INTERACTIONS OF CARNOSINE AND OTHER DIPEPTIDES VS. GLUCOSE

Dr. Manuel Gonzalez-Perez\*

Sciences of Biomedical Engineering. Interdisciplinary Postgraduate Center. Popular Autonomous University of The State of Puebla Mexico.

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\*Corresponding Author

Dr. Manuel Gonzalez-  
Perez

Sciences of Biomedical  
Engineering.

Interdisciplinary

Postgraduate Center.

Popular Autonomous

University of The State of

Puebla Mexico.

### ABSTRACT

The treatments with carnosine and other peptides have revolutionized science in recent years. Researchers show that treatment with carnosine improves glucose (GLU) metabolism, albuminuria, and pathology. The objective of this research was to analyze the chemical-quantum interactions of GLU with pure amino acids (AAs) and dipeptides. The hyperchem simulator was used to perform quantum calculations. These calculations are based on the Electron Transfer Coefficient (ETC). The following discoveries were made: the GLU is very aggressive and can attack any AA in its pure state. GLU also attacks dipeptides, polypeptides, and biological tissue. Carnosine has an ETC = 33.824, and there are other dipeptides with lower ETC. All dipeptides of Histidine (His) keep their ETC value = 33.824 constant, which is the ETC value of carnosine. It concluded that all dipeptides of His must have similar behavior to carnosine. Laboratory studies of these His

dipeptides are suggested in order to control blood GLU and nephropathies for diabetic patients.

**KEYWORDS:** Diabetes, Quantum chemistry, Carnosine, Dipeptides, Glucose.

### INTRODUCTION

The treatments with carnosine and other peptides<sup>[1-5]</sup> have revolutionized science in recent years. Researchers show that treatment with carnosine improves GLU metabolism, albuminuria, and pathology in mice. Therefore, carnosine could be a new therapeutic strategy to treat patients with Diabetic Nephropathy (DN) or be used to prevent DN in patients with diabetes.<sup>[6-10]</sup>

In other studies, carnosine, an endogenous dipeptide, showed significant recovery effects in the development of the neural tube. Higher expression levels of the Pax3 protein were found in the groups treated with carnosine. Also, the abnormal O-GlcNAcylation of the Pax3 protein was restored by carnosine. In this study, the molecular mechanisms of embryonic neurogenesis influenced by hyperglycemia were investigated using chicken embryo models. These results suggest new knowledge about the use of endogenous nutrients for the protection of the embryonic neurological development affected by the gestation of diabetes.<sup>[11]</sup> Another advantage of carnosine is that it can be a promising candidate to inhibit astrogliosis and promote the recovery of neurological function after ischemic stroke.<sup>[12]</sup>

On the other hand, the systemic and hepatic effects of the counterregulatory hormones and the glutamine dipeptide were investigated during episodes of hypoglycaemia, and it was found that during hepatic perfusion, gluconeogenesis was possibly the main route that led to the release of GLU.<sup>[13,14]</sup>

Arginine ( $C_6H_{14}N_4O_2$ ) is nutritionally classified as a conditionally essential amino acid that can be commonly found in the protein component of plants and foods of animal origin. In the last two decades, studies have described its role as a mediator of multiple biological processes that include the release of various hormones, collagen synthesis during wound healing, antitumor activity, and immune cell responses. Typically, endogenous synthesis accounts for approximately 20% of daily expenditure, and normal levels of arginine in the blood range of 40 to 100  $\mu\text{mol} / \text{L}$ , which can decrease by up to 20% in diabetes.<sup>[15]</sup>

The objective of this research was to analyze the chemical-quantum interactions of GLU with pure amino acids (AAs) and dipeptides.

## METHODOLOGY

The hyperchem simulator was used to perform quantum calculations. These calculations are based on the Electron Transfer Coefficient (ETC) theory published in other articles. The same author also already published the database. In this database, it shows the ETCs of twenty AAs.<sup>[16-23]</sup>

## RESULTS AND DISCUSSIONS

In Table 1 it can be seen that the GLU has a higher ETC than any of the AAs. Due to its high ETC, the GLU is very reactive with each of the AA.

On the other hand, it is observed that the Arg has the lowest ETC of the table; this tells us that this AA is the most stable of all.