ECRONICON OPEN ACCESS

EC DIABETES AND METABOLIC RESEARCH
Research Article

Evaluation of Selectins, Membrane Potential and Antioxidant Vitamins in Diabetic Patients Attending General Hospital Owerri

Nnodim Johnkennedy[1]*, Nwaokoro Joakin Chidozie[2], Edward Ukamaka[1] and Nkiruka Oly-Alawuba[3]

[1]Department of Medical Laboratory Science, Faculty of Health Science, Imo State University, Owerri, Nigeria

[2]Department of Public Health, Federal University of Technology, Owerri, Imo State, Nigeria

[3]Department of Nutrition and Dietetics, Faculty of Health Science, Imo State University, Owerri, Nigeria

***Corresponding Author:** Nnodim Johnkennedy, Department of Medical Laboratory Science, Faculty of Health Science, Imo State University, Owerri, Nigeria.

Received: June 23, 2020; **Published:** September 30, 2020

Abstract

Aim: The levels of serum Selectins (P and E-Selectin), membrane potential and antioxidant vitamins were determined in diabetic patients attending General Hospital Owerri, Nigeria.

Materials and Methods: A case control study involving 600 diabetics between the ages of 20 and 60 years attending General Hospital Owerri. Also, 600 apparently healthy persons within the ages of 20 and 60 years served as control. Fasting venous blood was collected for the determination of serum P-selectin, E-selectin, membrane potential, vitamins C and E. The serum selectins and vitamins were estimated using enzyme linked immunosorbent assay (ELISA). While membrane potential was calculated using Nerst equation. The Independent Student t test was used for statistical analysis.

Results: The levels of P-Selectin and E-Selectin were significantly higher in diabetes ($p < 0.05$), when compared with the control. The levels of membrane potential, vitamin C and Vitamin E were significantly decreased in diabetes ($p < 0.05$), when compared with the control.

Conclusion: The result suggests, that diabetes could probably be associated with increased P-Selectin and E-Selectin levels which may be useful diagnostic tool for predicting the severity of diabetes. Also, the decreased membrane potential could be linked to decreased energy while reduced vitamins in diabetes could be linked to oxidative stress.

Keywords: *P-selectin; E Selectin; Membrane Potential; Vitamin C and E*

Introduction

Diabetes is a disorder of metabolism which is the way the bodies use digested food for growth and energy [1]. There are three main types of diabetes: type 1, type 2 and gestational diabetes. Type 1 diabetes is referred as juvenile diabetes [2]. It can also called insulin-dependent diabetes, is a chronic condition in which there is malfunction of the pancreas which produces little or no insulin [3]. Insulin is a hormone needed to allow glucose to enter cells to release energy. It is a number of diseases that involve problems with the hormone insulin. In fact, the pancreas produces insulin to aid the body store and use the sugar and fat from the eaten food. It can occur when the pancreas produces very small or no insulin, or when the body does not respond adequately to insulin [4,5].

Genetics and some viruses may be likely factors that lead to type 1 diabetes. This type 1 diabetes appears during childhood or adolescence [6].

It may be characterized by the following: Increased thirst, excessive urination, extreme hunger, unintended weight loss, irritability and other mood changes, fatigue and weakness as well as blurred vision [7].

It could be caused by the body's own immune system - which normally fights harmful bacteria and viruses -which mistakenly destroys the insulin-producing islet, or islets of Langerhans cells in the pancreas [8].

Membrane potential simply implies the difference in charges between the internal and external of a neuron, which is created due to the unequal distribution of ions on both sides of the cell. It is the difference between the electric potential in the intracellular and extracellular matrices of the cell when it is not excited. Each cell of the body has its own membrane potential, but only excitable cells - nerves and muscles - are capable to change it and generate an action potential. It is quite necessary to note that there are many ions in the cell and extracellular space, but not all of them can sieve through the cell membrane. Those that can, are diffusible ions (sodium, potassium, calcium and chloride), and those that cannot are non-diffusible ions (proteins). Hence, both groups of ions contribute to membrane potential [13].

This membrane potential could be as a result of unequalities in concentration and permeability of important ions across a membrane. Because of the disparity concentrations of ions across a membrane, the membrane has an electrical charge. Membrane potential could also be referred as the difference in voltage between the internal and external of a cell. It is necessary to note that Sodium-potassium pumps move two potassium ions into the cell as three sodium ions are pumped out to maintain the negatively-charged membrane inside the cell. As a result, helps to maintain the membrane potential. Antioxidants like vitamins C and E may be necessary for maintenance of membrane potential [14].

Antioxidants are substances that can prevent or reduce damage to cells associated with free radicals [8]. They are sometimes called "free-radical scavengers. The sources of antioxidants can be natural or artificial [9]. These antioxidants help to neutralize free radicals in the bodies, and hence boost overall health It can protect against the cell damage that free radicals cause, known as oxidative stress [9,10]. The examples of antioxidants include: vitamin A, vitamin C, vitamin E, beta-carotene etc [11,12].

Diabetes is highly common with its attendant morbidity and mortality. It is on the light of the above that this study was embarked upon to evaluate status of E selectin and P selectin, membrane potential and antioxidant vitamins in diabetes. This study was equally undertaken so that the knowledge gained from the research work may suggest a better understanding and management of diabetes.

Materials and Methods

Research design

A case control study design was conducted in General Hospital Owerri from January, 2017 to October, 2017.

Subjects

A total of 600 confirmed diabetic patients within the ages of 20 - 60 years attending General Hospital Owerri were involved in the study while 600 apparently healthy non-diabetic within the ages of 20 - 60 years served as control.

Blood collection

In all subjects 4 ml of fasting veinous blood was collected into plain tubes. The serum was separated into a clean dry bijou bottle after centrifuging the whole blood in westerfuge (model 684) centrifuge at 5,000g for 10 minutes. Informed consent of the participants was obtained and was conducted in line with the ethical approval of the hospital.

Biochemical assay

The serum selectins, vitamin C and E were determined by Enzyme link immunosorbent method [13].

The serum calcium was estimated using Randox Kit. While membrane potential was determined by calculation using Nerst Equation [14].

Statistical analysis

The results were expressed as mean ± standard deviation. The statistical evaluation of data was performed by using independent students t- test. The level of significance was calculated at $p < 0.05$.

Result

Parameters	Diabetics	Control
E Selectin (ng/ml)	45.74 ± 6.11*	14.20 ± 4.76
P Selectin (ng/ml)	142.22 ± 4.99*	106.65 ± 8.88
Membrane potential (J)	159.83 ± 11.43*	266.65 ± 14.77
Vitamin C (mg/ml)	8.79 ± 0.40*	4.72 ± 0.62
Vitamin E (mg/ml)	0.99 ± 0.60*	1.53 ± 0.84

Table 1: *The levels of E and P-selectins, membrane potential and vitamin s C and E among diabetics and control subjects.*

**: Significantly different from control at P < 0.05.*

Discussion

Diabetes is a situation that impairs the body's ability to process blood glucose. Diabetes can lead to a buildup of glucose in the blood, which can increase the risk of dangerous complications like heart disease [15,16].

In this study, the level of P-selectin was significantly increased in diabetics when compared with non-diabetics. The higher levels of P-selectin in diabetics suggest that the excess circulating P-selectin contributes to the pathogenesis of poor insulin regulation. This is in line with the work of Agwunobi KE., *et al* [17].

In the same vein, the level of E-selectin was significantly increased in diabetics when compared with non-diabetics. This could probably be linked to oxidative stress in diabetics. This is in agreement with the work of [13].

On the other hand, the level of membrane potential was significantly decreased in diabetics when compared with non diabetics. This could probably be linked to a disruption of electron transport chains in diabetics [18]. In the same vein, poor sodium potassium pump could be implicated in the decrease in membrane potential among diabetics. This sodium-potassium pump uses energy to expel 3 molecules of sodium in exchange for 2 molecules of potassium. This is useful due to the fact that this pump creates concentration gradients for sodium and potassium, promoting more sodium in the extracellular space, and more potassium in the intracellular space.

Furthermore, the levels of vitamin C and vitamin E were significantly decreased in diabetics when compared with non-diabetics. This may be linked to cell damage and an increase in enzymes that generate free radicals [19,20]. This is in line with the work of [21] in which antioxidant vitamins were decreased.

Conclusion

In conclusion, diabetics could be associated with high levels of E-Selectin and P- Selectin as well as decreased levels of vitamins C and E which could enhance the risk of complications. Hence, E-Selectin and P- Selectin could be an important diagnostic tool in diabetic patients.

Bibliography

1. Saedi E., *et al.* "Diabetes mellitus and cognitive impairments". *World Journal of Diabetes* 7.17 (2016): 412-422.
2. Krishnasamy S and Abell TL. "Diabetic Gastroparesis: Principles and Current Trends in Management". *Diabetes Therapy* 9.1 (2018): 1-42.
3. Ripsin CM., *et al.* "Management of blood glucose in type 2 diabetes mellitus". *American Family Physician* 79.1 (2009): 29-36.
4. Cooke DW and Plotnick L. "Type 1 diabetes mellitus in pediatrics". *Pediatrics in Review* 29.11 (2008): 374-384.
5. Chiang JL., *et al.* "Type 1 diabetes through the life span: a position statement of the American Diabetes Association". *Diabetes Care* 37.7 (2014): 2034-2054.
6. Yang Y., *et al.* "Diabetes mellitus and risk of falls in older adults: a systematic review and meta-analysis". *Age and Ageing* 45.6 (2016): 761-767.
7. Kitabchi AE., *et al.* "Hyperglycemic crises in adult patients with diabetes". *Diabetes Care* 32.7 (2009): 1335-1343.
8. Lemmo W. "Potential interactions of prescription and over-the-counter medications having antioxidant capabilities with radiation and chemotherapy". *International Journal of Cancer* 137.11 (2014): 2525-2533.
9. Bjelakovic G., *et al.* "Mortality in randomized trials of antioxidant supplements for primary and secondary prevention: systematic review and meta-analysis". *The Journal of the American Medical Association* 297.8 (2007): 842-857.
10. Abner EL., *et al.* "Vitamin E and all-cause mortality: a meta-analysis". *Current Aging Science* 4.2 (2011): 158-170.
11. Bjelakovic G., *et al.* "Antioxidant supplements for prevention of mortality in healthy participants and patients with various diseases". *The Cochrane Database of Systematic Reviews* 3.3 (2012).
12. Valko M., *et al.* "Free radicals and antioxidants in normal physiological functions and human disease". *The International Journal of Biochemistry and Cell Biology* 39.1 (2007): 44-84.
13. Nnodim JK., *et al.* "Alteration of Cell Adhesion Molecules in Sickle Cell Anemia". *Iatrology Archives* 1.1 (2020): 1-5.
14. Nnodim JK., *et al.* "Membrane depolarization in stroke patients". *Acta Medica Scientia* 03.04 (2016): 9-11.
15. Verrotti A., *et al.* "Seizures and type 1 diabetes mellitus: current state of knowledge". *European Journal of Endocrinology* 167.6 (2012): 749-758.
16. Vertuani S., *et al.* "The antioxidants and pro-antioxidants network: an overview". *Current Pharmaceutical Design* 10.14 (2004): 1677-1694.
17. Agwunobi KE., *et al.* "Association of Cell Adhesion Molecules, Glycated Haemoglobin and Some Haematological Parameters with Diurnal Variation of Blood Pressure among". *Hypertensives Archives of Nephrology* 3.1 (2020): 01-07.
18. Kofuji P and Newman EA. "Potassium buffering in the central nervous system". *Neuroscience* 129.4 (2004): 1045-1056.

19. Nnodim JK., *et al.* "Evaluation of Albumin, Zinc and Vitamin C in Surgical Wound Patients". *Medical Science and Healthcare Practice* 1.2 (2017): 60-66.

20. Obi PC., *et al.* "Pattern of Serum Testosterone and Glycated Haemoglobin among Adult Males with Type 2 Diabetes Mellitus and Erectile Dysfunction Attending a Tertiary Hospital in South Eastern Nigeria". *British Journal of Medicine and Medical Research* 18.1 (2016): 1-8.

21. Nwodo EI., *et al.* "Vitamins C and E levels are enhanced by *Azadirachta indica* aqueous extract in Paracetamol induced hepatoxicity in wistar rats". *Journal of Medicinal Plants Research* 10.24 (2016): 338-343.

Volume 4 Issue 10 October 2020
©All rights reserved by Nnodim Johnkennedy*., et al.*