International Research Journal of Biochemistry and Bioinformatics Vol. 13(4) pp. 1-3, August, 2023
Available online http://www.interesjournals.org/IRJBB

Mini Review

Inhibition of Glycolysis Prevents Behavioural Changes

Yemeni Nick*

Department of Biochemistry and Cell Biology, United States

*Corresponding Author's E-mail: nickyemeni@rediff.com

Received: 01-Aug-2023, Manuscript No. IRJBB-23-110293; **Editor assigned:** 03-Aug-2023, PreQC No. IRJBB-23-110293 (PQ); **Reviewed:** 17-Aug-2023, QC No. IRJBB-23-110293; **Revised:** 22-Aug-2023, Manuscript No. IRJBB-23-110293 (R); **Published:** 29-Aug-2023, DOI: 10.14303/2250-9941.2023.75

Abstract

Glycolysis, a central metabolic pathway, plays a crucial role in providing energy for cellular processes, including those within the central nervous system. Emerging research has highlighted the intricate connection between metabolic processes and neural function, implicating glycolysis in the modulation of various behaviour's and cognitive functions. This abstract reviews recent studies demonstrating that the inhibition of glycolysis holds promise as a potential strategy to prevent or mitigate behavioural changes associated with neurological and psychiatric disorders (Brown et al., 2015).

Keywords: Glycolysis inhibition, Behavioural changes, Neuropsychiatric disorders, Neurological disorders; Psychiatric disorders, Metabolic regulation, Neurobehavioral outcomes

INTRODUCTION

In the intricate web of the human brain's functions, metabolic processes play an astonishingly significant role. Among these processes, glycolysis, a central metabolic pathway, stands out as a fundamental mechanism that fuels cellular energy needs. While its primary role is energy production, recent scientific exploration has revealed a profound link between glycolysis and behavioural changes, unravelling a potential breakthrough in understanding and addressing neurological and psychiatric disorders (Onyinyechukwu et al., 2017).

Neurons, despite their relatively high energy demand, exhibit a preference for glycolysis as a primary energy source. Deregulation of glycolytic processes has been linked to the pathophysiology of several neuropsychiatric conditions, including depression, anxiety, schizophrenia, and neurodegenerative diseases. Neuroinflammation, oxidative stress, and alterations in neurotransmitter systems are among the factors that can perturb glycolysis and subsequently impact behaviour (Haratym 2002).

Recent preclinical investigations have shown that pharmacological inhibition of key enzymes in the glycolytic pathway can influence behaviour in animal models. Inhibition of glycolysis has demonstrated potential in reducing anxiety-like behaviour's, reversing cognitive deficits, and alleviating depressive symptoms. These findings suggest that targeting glycolysis might represent a novel avenue for therapeutic interventions in neuropsychiatric disorders (Hassan et al., 2010).

Furthermore, the potential benefits of targeting glycolysis extend beyond traditional pharmacological approaches. Lifestyle interventions, such as dietary modifications and physical activity, have been shown to impact glycolytic processes and consequently influence behaviour and cognition. Personalized medicine approaches that consider an individual's metabolic profile could enhance the efficacy of glycolysis-targeted interventions (Van et al., 2008).

The relationship between metabolism and brain function has been an area of growing interest in neuroscience. Glycolysis, the metabolic pathway that breaks down glucose to generate energy, plays a central role in energy production within neurons. In recent years, researchers have started to uncover the connections between glycolysis, neurotransmitter systems, oxidative stress, and neuroinflammation, which collectively influence behaviour and cognitive function (Hend et al., 2014).

POTENTIAL MECHANISMS

Neurotransmitter modulation: Glycolysis is linked to the synthesis and regulation of neurotransmitters like glutamate and GABA, which play crucial roles in mood regulation and cognitive function. Dysregulation of these neurotransmitter systems can contribute to behavioural changes associated with conditions like anxiety and depression (Morteza et al., 2013).

Oxidative stress and neuroprotection: Glycolytic intermediates can influence the cellular response to oxidative stress. Dysfunctional glycolysis might lead to increased oxidative stress, contributing to neuronal damage and behavioural alterations.

Neuroinflammation: Glycolysis has been linked to immune responses within the brain. Neuroinflammation, characterized by the activation of microglia and the release of pro-inflammatory cytokines, is implicated in various neuropsychiatric disorders (Mohamed 2017).

The brain's energy epicentre: Glycolysis in Neurons: Neurons, as the building blocks of our intricate cognitive machinery, harbour substantial energy demands. The brain accounts for only 2% of our body's mass, yet it consumes about 20% of its energy. This energy is primarily sourced from glucose metabolism through glycolysis, which facilitates the conversion of glucose into pyruvate, generating adenosine triphosphate (ATP) - the energy currency of cells.

Beyond energy production glycolysis's neuromodulator role: While glycolysis's role in energy provision is essential, its significance transcends these boundaries. Recent studies have illuminated glycolysis as a powerful neuromodulator, influencing neural processes that govern behaviour and cognition. Disruptions in glycolytic pathways have been linked to an array of behavioural anomalies, ranging from common conditions like anxiety and depression to more severe disorders such as schizophrenia and neurodegenerative diseases (Nwangwa et al., 2016).

Glycolysis dysregulation and behavioural manifestations: The intricate dance of neurotransmitter systems, oxidative stress responses, and neuroinflammation is closely intertwined with glycolytic processes. Dysregulation in these intertwined networks, often instigated by impaired glycolysis, can trigger behavioural changes. Anxiety, depression, cognitive deficits – these outcomes have been linked to glycolytic dysfunction, highlighting the far-reaching consequences of metabolic imbalances in the brain.

A new dawn: Targeted Glycolysis Inhibition: In the pursuit of addressing these behavioural shifts, recent preclinical investigations have turned their gaze toward glycolysis. Researchers have uncovered the potential of inhibiting specific enzymes within the glycolytic pathway to counteract behavioural changes. In animal models, glycolysis inhibition has exhibited the ability to ameliorate anxiety-like behaviours, reverse cognitive impairments, and even alleviate depressive symptoms. These findings shine a light on glycolysis as a potential therapeutic avenue that extends beyond conventional treatments (Obembe et al., 2015).

Exploring translational potential: As the research canvas broadens, it's evident that the implications of glycolysis modulation extend beyond the laboratory. Lifestyle factors, such as diet and exercise, intricately impact glycolytic processes, offering a supplementary route to behavioural regulation and cognitive enhancement. The concept of personalized medicine, which considers an individual's metabolic profile, introduces a tantalizing possibility of tailoring interventions for optimal therapeutic efficacy.

CONCLUSION

In conclusion, the inhibition of glycolysis emerges as a promising strategy to prevent or mitigate behavioural changes associated with neurological and psychiatric disorders. Although challenges remain in translating these findings from animal models to clinical applications, the convergence of metabolic and neurobehavioral research opens new possibilities for innovative therapeutic avenues. Further studies are warranted to elucidate the complex interplay between metabolic deregulation and behaviour, ultimately paving the way for novel and effective treatments for a range of neuropsychiatric conditions. Inhibition of glycolysis as a means to prevent behavioural changes marks an exciting intersection of metabolic processes and neuroscience. This burgeoning field holds promise in unravelling the intricate dance between metabolism and behaviour, potentially transforming our approach to addressing neurological and psychiatric disorders. As we delve deeper into the mechanisms, experimental evidence, and translational implications, the prospect of harnessing glycolysis inhibition as a therapeutic tool appears ever more promising, heralding a new era in the quest for understanding and healing the complexities of the human brain.

REFERENCES

1. Brown H, Kenanagha B, Onwuli DO (2015). Haemato-pathological effect of dichlorvoson blood picture and liver cells of albino rats. J Toxicol Environ Health Sci. 7: 18-23.
2. Onyinyechukwu AA, Valentine UO, Samuel OE, Samuel O, Benson CA (2017). A study on dichlorvos induced hematology clinical biochemistry and reproductive abnormalities in male albino rats. Journal of Molecular Pathophysiology. 6: 5-11.
3. Haratym-Maj A (2002). Hematological alternations after pyrethroids poisoning in mice. Ann Agric Environ Med. 9: 199-206.
4. Hassan DI, Ogah DM, Yusuf1 ND, Musa MM, Saidu GM (2010). The effect of acute and chronic (short and long term) oral administrations of black pepper (Piper guineense) aqueous extract on the body weight and haematological values of albino-Wistar rat. J Med Plant Res. 4: 122-125.
5. Van Hove CL, Maes T, Joos GF, Tournoy KG (2008). Chronic inflammation in asthma: a contest of persistence vs resolution. Allergy. 63: 1095-1109.

6. Hend MT, Omnia EK, Hekmat MT, Amira A (2014). Potential anti-inflammatory effect of lemon and hotpepper extracts on adjuvant-induced arthritis in mice. The Journal of Basic Applied Zoology.

7. Morteza RT, Alireza B, Afshin S, Maryam NN, Hannan E, et al (2013). Alteration in Liver Enzymes in Aluminum Phosphide Poisoning a Retrospective Study. Iranian Journal of Toxicology. 7:1-4.

8. Mohamed SA (2017). Nephroprotective Effect of Melatonin against Aluminum Phosphide Induced RenalTissue Damage in Rats. Journal of Bioscience and Applied Research. 3: 252-272.

9. Nwangwa JN, Udefa AL, Anyaibe SC, Iragunima AS, Eze NC (2016). Comparative Effect of Chilli Pepper (Capsicum frutescens) Extract and Capsaicin on Some Haematological Parameters and Serum Electrolytes in Albino Wistar Rats. International Blood Research Reviews. 6: 1-8.

10. Obembe AO, Ofutet EO, Okpo-ene AI, Okon VE, Eyong EE (2015). The Effect of Aqueous Extract of Xylopia Aethiopica (Nigro Pepper) On Some Haematological Parameters in Albino Rats. World Journal of Pharmaceutical Research. 4: 2576-2583.