A possible role of arsenic exposure in diabetes and obesity

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ABSTRACT

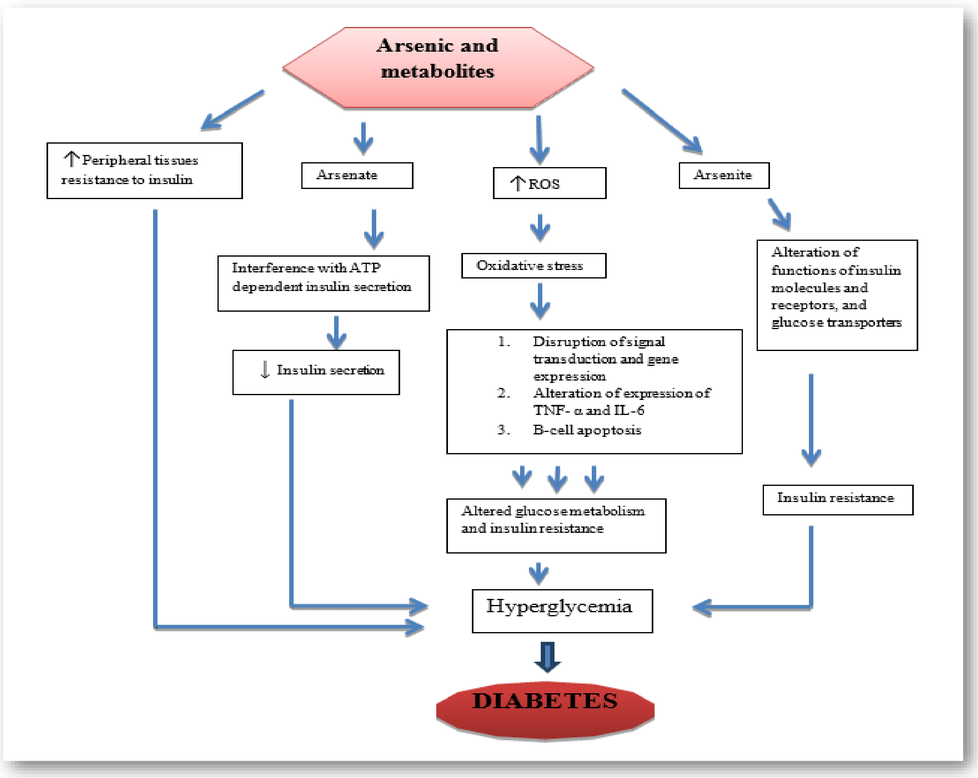
In the modern world, obesity and diabetes are the most prevalent diseases. Around 39% of adults worldwide are obese and approximately 422 million are diabetics, according to the WHO. A complex disease, obesity is caused by body fat accumulation and a body mass index of 30 kg/m2 or higher. Generally, it is caused by genetic and lifestyle factors. As a result, it is more likely to develop diabetes mellitus, dyslipidemia, and cardiovascul8ar diseases as well. People who consume too much energy store the excess energy as glycogen in their adipose tissues, resulting in insulin resistance. Melanocortin 4 receptor (MC4R) responsible for lipid homeostasis leads to obesity, while overexpression of Transcription Factor 7 like 2 (TCF7L2) induces diabetes. The aim of this study is to investigate the impact of arsenic on obesity and diabetes. In the current environment, people are exposed to a lot of chemicals, such as polychlorinated biphenyls, and heavy metals such as mercury and arsenic. As a consequence, lipodystrophy and lipolysis are enhanced. In the adipose tissue, arsenic interferes with signal pathways such as Sirtuin3 (SIRT 3) and Forkhead Box O3 (FOX O3). By generating free radicals and inhibiting anti-oxidants, it elevates reactive oxygen species and causes oxidative stress. A major role that melatonin plays as a therapy for arsenic-induced diabetes is as a free radical scavenger. Pineal glands release melatonin, which has a lipophilic nature and can pass through all intracellular organs, preventing lipid peroxidation, reducing oxidative stress, and preventing cell death. Researchers are testing microRNA regulators as well as resveratrol to see if they can control arsenic-induced diabetes.

Keywords: obesity, diabetes, arsenic, insulin resistance, melatonin, oxidative stress

INTRODUCTION

Obesity and diabetes are the two most common diseases of all age groups irrespective of gender, race and socio-economic status. Obesity is a multi- factorial disease, which is not caused by a specific pattern of one gene and can lead to diseases of multiple genes like Diabetes mellitus. The accumulated adipose tissue impairs the function of beta cells eventually causing insulin resistance that gives rise to chronic kidney disease and cardiovascular diseases. Other complications of diabetes include hyperglycemia, hyperlipidemia, nerve damage and Alzheimer's disease which are resulted from factors like sedentary lifestyle, unhealthy diet, genetic mutations and vitamin D deficiency.

Arsenic is a metalloid that is released from coal power plants and mining which has adverse effects on various mechanisms in our body. It has been found out that arsenic elevates serum lipid levels, raises insulin resistance and increases birth and postnatal weight gains. It is proved to be harmful for the white adipose tissues by decelerating adipogenesis and enhancing lipolysis. Arsenic generates intracellular reactive oxygen species that alter multiple signaling pathways thereby resulting in oxidative stress. Arsenate interferes with the ATP dependent secretion and arsenite impairs the function of glucose transporters. The therapeutic that is most commonly used for Arsenic induced diabetes is melatonin that reduces the antioxidant imbalance by its lipophilic nature.



SIGNALLING PATHWAYS AND ITS FUNCTIONS

Table 1: Signalling pathways and its function

Signalling pathways	Symbol	Function
Sirtuin-3	SIRT-3	These are NAD+ depedent histone deacetylases that helps in the regulation of metabolic pathwys
Forkhead box O3	FOX O3	It regulate autophagy, proliferation and cell size
Mitogen-activated protein kinase	MAP K	It plays a major role in regulating cellular programs by relaying signals to intracellular responses
Phosphoinositide dependent kinase	PDPK	Activates AGC kinase including cAMP dependent protein kinase

CONCLUSION

The study investigates the impact of arsenic exposure on various metabolic pathways and the mechanism of Diabetes mellitus. Recently, newer therapeutics have been discovered for treating Diabetes such as melatonin, microRNA regulators and resveratrol.

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