DIABETES: A TOXICOLOGICAL VIEW

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ABSTRACT

In modern era diabetes is a growing problem. Prevalence rate of diabetes increased since few years. There are some responsible causes for diabetes like physiological, chemical, pathological, toxicological, pathophysiological i.e failure of beta cell functioning and insulin resistance. There are also environmental pollutants such as arsenic, lead, mercury, organophosphorus compound responsible for diabetes. In the absence of increased caloric intake; exposure to environmental toxins leading to weight gain and insulin resistance.[1] The science related to combination of food is called as topography. Incompatible diet leads to many metabolic disorders like, diabetes, obesity, cancer, etc. In *Prameha Vyadhi* (Diabetes) frequently taken of *Viruddha Ahara* (incompatible diet) leads to *Kleda Vriddhi* (increased moisture) and it plays predominant role in *Prameha Samprapti* (pathology of diabetes), it creates *Agnimandya* (indigestion), *Ama* (biotoxin) and number of metabolic disorders. Diabetes also one of the metabolic disorder. *Madya Vishaktata* (alcohol toxicity) is also described in Ayurvedic Samhita. It is one of the main risk factor of diabetes. Alcoholism can cause diabetes by decreasing insulin sensitivity, increasing body weight and leading to obesity which is primary cause of Type-2 diabetes. In present article, I am going to high lighten the relation between toxicological substance and diabetes.

KEYWORDS: Diabetes, Toxins, Incompatible diet, insulin resistance.

INTRODUCTION

In the living being body cell and tissue are continuously gone through the convention & dis-convention process in a meticulous manner involving some metabolic pathways. External and internal factor disturbing metabolic processes may leads various metabolic disorders and also life-threatening diseases.[2] An estimated 25% of us have some form of heavy metal poisoning. Some study has shown that exposure to toxic metal such as mercury, cadmium, lead, arsenic, aluminium and other heavy metal can be linked to autoimmune process. Heavy metal induced auto-antibodies which create the autoimmune and metabolic diseases. Toxins such as pesticides, solvents, industrial chemical, household cleaners and hair dyes are being implicated autoimmune diseases. These toxins are everywhere and they greatly increase risk of all disease in general. Smoking increased risk of several autoimmune disease primarily because of chemicals in cigarettes. *Acharya Charaka*, explained in detail and said that person who consume *Viruddha ahara* (incompatible diet) is prone to imbalance of *Doshas* (vitiating factors) causes many disorders. According to *Acharya Charaka, Asyasukha* (eating as per one's will), *Swapnasukha* (addiction to the pleasure of sedentary habits and sleep), *Dadhini* (excess intake of curds), *Gramyodakanupa rasa* (soup of meat of domesticated and aquatic animals and animals from marshy land), *Payansi* (excess intake of milk and its products), *Navannapanam* (freshly harvested grains, freshly prepared alcoholic drinks), *Gudavaikrita* (preparation of jaggery and its product) and other aggregating factor are responsible.[3] Due to globalisation and urbanisation many metabolic disorders are growing problem of present era. People are unaware from causative and aggregating factors of diabetes and also there is lack of knowledge about this. So, I have been selected this topic for awaring and educating people towards toxins and its relation to metabolic disorders especially diabetes and represented systematically.

AIM: To study toxicological causes and its relationship with diabetes.

OBJECTIVE

1) To study toxicological causes in detail.
2) To known relation between toxin and diabetes.

METHODOLOGY
To fulfil the aim and objective of the study this work has been carried out in the following phase wise manner.
1) Conceptual study
2) Comparative study
3) Discussion
4) Conclusion

Concept of toxin
Toxin is a poisonous substance produced within cells or organism. Toxin can be small molecule, peptides, or proteins that are capable of causing on contact with or absorption by body tissue interacting with biological macromolecules such as enzymes or cellular receptor. Toxins vary greatly in their toxicity ranging from usually minor (such as bee sting) to almost immediately death (such as botulinum toxin). Toxins are often distinguished from other chemical agents by their method of production i.e it simply means it is a biologically produced poison. Toxins are poisonous product of organism; unlike biological agent, they are inanimate and not capable of reproducing themselves. It means toxic material or product of plant, animal, microorganisms including bacteria, virus, fungi or protozoa or infectious substance or a recombinant all synthesized molecule, whatever their origin and method of production.[4]

Concept of Diabetes and *Prameha*
Diabetes is a metabolic disorder containing main two groups type-1 and type-2 respectively. Type-1 i.e. insulin dependent caused by destruction of immune mediated β-cells and causes insulin deficiency. Type-2 i.e. non-insulin dependent diabetes caused due to defect in secretion of insulin and leads to insulin resistance.[5] Due to prolonged period of increased blood glucose level leads to many macro and micro vascular complications wisely stroke, cardio-vascular diseases, neuropathy, nephropathy, retinopathy also peripheral vascular diseases.[6] Obesity in combination with sedentary lifestyle are the main risk factor for Type-2 Diabetes.[7] Diabetes is symptomatically corelated with *Prameha Vyadhi* mentioned in Ayurvedic literature. *Acharya Charaka* explained *samprapti* (pathogenesis) of *Prameha*. Frequently taken above *hetus* (causative factors) explained by *Acharya Charaka* for long period; decrease all these three-vitiated factors i.e. *Vata, Pitta* and *Kapha* responsible for *Samprapti* (pathogenesis) of *Prameha* especially *Kapha Vriddhi*. Vitiated *Kapha dosha* play predominant role in vitiating all ten which are responsible for pathogenesis i.e. *Kapha, Pitta, Vata, Meda, Rakta, Shukra, Ambu, Vasa, Lasika, Majja* and *Mamsa*. Due to increased *Kapha Dosha* and *Kleda Vruddhi* 20 types of *Prameha* formed.[3]

Toxins and Diabetes
Our stationary, stressful lifestyle and increased glycaemic rate, low fibre, trans fat or saturated fat and phytonutrient – poor diet plays contributory role in epidemic of Diabetes and obesity. Due to increasing burden of environmental toxins which involves exposure to persistent organic pollutants and heavy metals. These factors are responsible for diabetes. These toxins interfere with cholesterol and glucose metabolism which induce insulin resistance. Toxins which motivate insulin resistance and obesity through various mechanisms including oxidative stress, impairment of central appetite regulation, mitochondrial injury and altered thyroid metabolism.[8] People had high serum level of pollutants had a highest risk for diabetes. Also, those who consume frequently contaminated sea food have higher risk of diabetes. Toxins motivate insulin resistance by obstructing the function of nuclear receptor class called as peroxisome proliferator activated receptors. It is needed for glucose control, fatty oxidation, optimal insulin function and regulation of inflammation.[9] Utilisation of advanced technique of metabolic and genetic analysis many researchers shown that toxin can increase level of cholesterol, glucose and fatty liver.[10]

Immoderate raised blood glucose is a main risk factor of type-2 diabetes, which is associated with impairment of insulin production by pancreatic β-cell or injury to the adipose tissues by insulin sensitivity. [11] Severity of Type-2 diabetes is depend on formation of advanced glycation products and mitochondrial damage. Both gives impact on oxidative stress and which plays significant role in Type-2 diabetes progression.

There is increase involvement about the human health hazards of inorganic arsenic due to extensive drinking water excrement around the world. Due to this concentration of inorganic arsenic in the ground water increases. National workshop related with toxicology concluded that if concentration of inorganic arsenic is more than 150μg/lit then there is association between inorganic arsenic and diabetes.[12] Preclinical study of inorganic arsenic affects the production and secretion of insulin from β-cell of pancreas.[13] Another study on rat indicate that it may affect production of oxidative stress of pancreas.[14] Exposure to inorganic arsenic may impair expression of genes which known to be related with insulin resistance and type-2 diabetes.[15]

Several recent researches concluded that environmental chemical exposures may lead to type-2 diabetes.[16] There is link between diabetes and environmental chemicals which arise from high exposure to occupational setting. Due to chronic exposure of carbon disulphide there is decrease in glucose tolerance which further lead to diabetes in worker.[17] People are expose to environmental chemicals by ingesting contaminated fat rich, highly processed, incompatible food. Children may also have suffered from contaminated breast milk. Pesticides commonly used in agriculture are organochlorines which includes insecticide, DDT (di-chloro, di-phenyl, tri-chloro ethane), chlordane etc. There is also evidence of correlation between concentration of dioxin or organochlorines and diabetes.[18] Derivative of DDT an imitate effect of endogenous oestrogen in the body which includes

various metabolic functions involving glucose transport. Organochlorines may also impact diabetic risk by stimulating obesity and adiposity.[19] Previous clinical study indicate that acute and chronic exposure of environmental tobacco smoke can interfere insulin stimulated glucose uptake.[20] Traffic related air pollution is also a triggering factor for diabetes. Recent research suggested that frequently exposure to organophosphate can increase risk of diabetes. Preclinical study on acute large dose exposure to organophosphates can produce hyperglycaemia.[21] Frequently exposure to organophosphate like diazinon and parathion in the neonatal period of rat shows continuous changes in metabolism resembling prediabetes.[22] Environmental chemicals are prevalent in all aspect of patient's life involving those which found in water, soil, air, food and consumer products. In pregnant women, environmental chemicals can cross placenta. Methyl mercury may be accumulating in the foetus which result in higher foetal exposure than maternal exposure.[23]

DISCUSSION
The sustainability of environment is directly proportional to the sustainability of health of total population. According to several researches, there is connection between toxins and their hazardous effects on metabolism are well demonstrated. The link between industrialisation, addiction to energy, various chemicals and heavy metals which are released into environment. The increased rate of epidemics of chronic illness which make us all stop unhealthy things and think about how we live. Aware and educate people about what kind of food is taken in day-to-day life and what kind of product purchased. There are dietary support and supplement are also useful for detoxification. Supplementary sources for detoxification are plants, minerals, proteins, vitamins, essential amino acids and phytonutrients which protects against oxidative stress, mitochondrial injury, inflammation induced by toxins. Some specific foods which contain high concentration of unique phytonutrients like glucosinolate or catechins which helps for detoxification. The burden on body of frequent organic pollutants and heavy metals must be registered in public health centres and organise treatment and precautional programme for toxin induced diabetes.

CONCLUSION
From considering, above reference and facts we may conclude that environmental toxins such as air pollutants, water pollutants and soil pollutants are responsible to increase risk of metabolic disorders like obesity, diabetes, etc. Inorganic chemicals like arsenic, other heavy metals, organophosphorus compounds are triggering factor for many disorders. Due to globalisation, there is increase rate of utilisation of pesticides in crop and cultivational science for hard and fast increment of food and other products due to increase need in day-to-day life. It leads to increase oxidative stress, mitochondrial injury which are the risk factors for diabetes. For prevention, there is need of educate the people about toxins and their relation with metabolic diseases like diabetes, obesity, cancer, etc. Conduction of various preventive programme may useful for awareness in population.

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