"A COMPETENT ANTI DIABETIC ACTIVITY OF SUSHRUTOKTA VIMSHATI YOGA IN THE REGULATION OF DIABETES MELLITUS- AN ANALYTICAL EVALUATION"

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ABSTRACT

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The degree of hyperglycemia may change over time, depending on the extent of the underlying disease process. It reflects the severity of the underlying metabolic process and its treatment more than the nature of the process itself. Achieving adequate glycemic control becomes a prime most factor in diabetes mellitus. The long stand intake of oral hypoglycemic therapy or insulin therapy has ample of adverse effects which significantly hampers physical as well as psychological health of an individual. *Ayurvedic* pharmacology emphasizes on adequate glycemic control as well as maintains individual's overall wellbeing by its holistic approach. *Ayurvedic Samhitha* primarily explains three types of *Prameha* which is further subdivided into twenty types, where it emphasizes on early, acute and chronic stages of diabetes mellitus. Thus an effort is made to analytically evaluate the anti-diabetic activity of *Sushrutokta Vimshati Yoga* in regulation of Diabetes mellitus.

Keywords: Diabetes mellitus, Anti diabetic activity, *Sushrutokta Vimshati Yoga,*.

INTRODUCTION

Diabetes mellitus is a metabolic disorder of multiple etiology, characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects of insulin secretion, insulin action or both. The long term effects of diabetes includes damage, dysfunction, and failure of various organs. The long term effects include progressive development of retinopathy with potential blindness, nephropathy that may lead to renal failure, neuropathy with risk of foot ulcers, amputation, Charcot joints, and features of autonomic dysfunction, including sexual dysfunction. Subjects with diabetes are at risk of cardiovascular, peripheral vascular, and cerebrovascular diseases.

Also, **Diabetes** is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The degree of hyperglycemia may change over time, depending on the extent of the underlying disease process. It reflects the severity of the underlying metabolic process and its treatment more than the nature of the process itself.

Prevalence of Diabetes mellitus globally is 422 million according to WHO and more than 62 million, which are more than 7.1% of adult population in India according to International Diabetes foundation. Achieving adequate glycemic control becomes a prime most factor in diabetes mellitus.

Classification

1. TYPE 1 DIABETES- Absolute Insulin Deficiency. IDDM
2. TYPE 2 DIABETES- Defects of insulin secretion or insulin action NIDDM
3. GESTATIONAL DIABETES-
4. OTHER TYPES:
   a. Genetic defects of beta cell
   b. Genetic defects in insulin action
   c. Diseases of the Pancreas
   d. Excess amounts of counter regulatory hormones
   e. Infections

f. Rare autoimmune disorders

g. Genetic syndrome associated with diabetes

5. PRE-DIABETES

Clinical features of Diabetes mellitus are variable and depend upon the type of diabetes and the stages of the natural history of diabetes at which it is seen. Many are ASYMPTOMATIC and remain silent for many years. Some may present with POLYURIA, POLYDIPSIA and POLYPHAGIA with WEAKNESS and WEIGHT LOSS. Also few may have long term complications like NEUROPATHY, RETINOPATHY and NEPHROPATHY at diagnosis.

Management includes Life style modifications, Oral Anti Diabetic drugs and Insulin Therapy.

The long stand intake of oral hypoglycemic therapy or insulin therapy has ample of adverse effects. *Ayurvedic* pharmacology emphasizes on adequate glycemic control as well as maintains individual's overall wellbeing by its holistic approach. Diabetes mellitus can be emphasized under *Prameha* due to the similarities possessed. *Ayurvedic Samhitha* primarily explains Premonitory symptoms, Signs and symptoms, Pathogenesis, Etiological, Therapeutic Clinico-pathological Classification of *Prameha* which emphasizes on early, acute and chronic stages of diabetes mellitus, Complications, Management modalities, Diet plan and also its prevention.

AIMS AND OBJECTIVES

- To analytically evaluate the anti-diabetic activity of *Sushrutokta Vimshati Yoga* in regulation of Diabetes mellitus.

MATERIALS AND METHODS

Analytical review on Anti Diabetic activity of *Vimshati Yoga:*

Kaphaja Meha

Prameha	Yoga	Botanical Name	Anti-Diabetic activity
01. UDAKA MEHA	PARIJAATA-PARIBHADRA	Nyctanthes arbostristis , Erythrina indica	**Root- Methanol- Hypoglycemic activity** **Alcoholic and aqueous extracts of stem bark- Phytosterols – Reduces FBS and improves insulin resistance ,Hypoglycemic activity**
02. IKSHU MEHA	VAIJAYANTI	Premna integrefolia	**Bark - Flavonoids, glycosides, Carotenoids- Reduces FBS, Promotes glucose metabolism, inhibits hepatic Gluconeogenesis, regenerates the damaged beta cells**
03.SURA MEHA	NIMBA	Azadirachta indica	**Leaf extract- Improves expression of insulin signaling molecules and GLUT4 protein to enhance oxidation in skeletal muscle**
04. SIKATA MEHA	CHITRAKA	Plumbago zeylanica	**Decreases the activity of glucose 6 phosphatase and Fructose 1,6 biphosphatase, enhances GLUT 4 mRNA and protein expression- GLUT 4 translocation and contributes to glucose homeostasis**
05. SHANAI MEHA	KHADIRA	Acacia catechu	**Leaves- Hydroethanolic acid- anti hyperglycemic activity by stimulating insulin release and inhibition of glucagon**

			secretion
06. LAVANA MEHA	PATA	Cyclea peltata, Cissampelos pariera	**Phenols, Flavonoids, alkaloids, tannins, terpenoids and sterols- Stimulate lipogenesis and glucose transport in adipocytes hence lowering blood sugar.**
	AGURU	Aquilaria agallocha	**Enhances glucose uptake by adipocytes, reduces FBS**
	HARIDRA	Curcuma longa	**Curcuminoids, glycosides, terpenoids, flavonoides- Inhibits human pancreatic Amylase, reduces starch hydrolysis**
07. PISHTA MEHA	DARUHARIDRA HARIDRA (mentioned earlier)	Berberis aristata	**Significantly decreases the blood glucose, total cholesterol and triglycerides.**
08.SAANDRA MEHA	SAPTAPARNA	Alstonia scholaris	**Bark- Reduces blood glucose levels, glycosylated hemoglobin and lipid peroxidation**
09. SHUKRA MEHA	DOORVA	Cynodon dactylon	**Reduces FBS, weight metabolism, restores stress induces sexual dysfunction**
	SHAIVALA	Ceratophyllum demersum	**Reduces serum glucose levels**
	PLAVA	Cyperus scariosus	**Quercitin, Gallic acid, 4-hydroxyl cinnamic acid- Anti diabetic activity by alpha glucosidase inhibition.**
	HATHA-	Pistia stratiotes	**Reduces blood glucose levels**

	JALAKUMBHIKA		
	KARANJA	Pongamia pinnata	**Enhances glucose utilization by peripheral tissues**
	KASERUKA	Scirpus grossus	**Saponin-Anti oxidant and anti glycation – By inhibiting late glycation and formation of advanced glycation end products (AGEs) on proteins.** **Improves sperm count**
	KAKUBHA	Terminalia arjuna	**Decreases activity of Glucose 6 phosphatase, Fructose 1,6 di phosphatase, aldolase Increases phosphoglucoisomerase , hexokinase.**
	CHANDANA	Santalum album	**Helps in overcoming insulin resistance, has potential anti hyper lipidemic activity**
10. PHENA MEHA	TRIPHALA- HARITAKI VIBHITAKI AMALAKI	Terminalia chebula Terminalia bellirica Emblica officinalis	**Reduces FBS, PPBS, Restores functioning ability of beta cell of pancreas, Regulates insulin metabolism, anti-inflammatory, helps in diabetic retinopathy, nephropathy and neuropathy**
	ARAGWADHA	Cassia fistula	**Increase insulin release, Prevents complication of microvasculature**
	MRUDWIKA	Vitis vinifera	**Radical scavenging- Plays role in Ischemia, Inflammation and DM** **Recovers the beta cells of pancreas**

Pittaja Meha

01.NILA MEHA	**SHALASARADI KASHAYA** **SALASARA**	**Shorea robusta**	Ethanol, flavanoids, tannins- Anti diabetic and Anti hyperlipidemic- Decreases plasma insulin
	AJAKARNA KHADIRA(explained earlier)	Vateria indica	**Enhances peripheral glucose uptake**
	KADARA	Acacia suma	**Normalizes FBS and liver enzymes.**
	KRAMUKA KALASKANDHA	Areca catechu Acacia farnesiana	**Restores biochemical parameters, regulates weight, reduces FBS** **Increase glucose uptake, reduces blood sugar levels**
	BHOORJA	Betula utilis	**Flavonoids, phenolics, phenylbutanoids, lignans- Anti diabetic, Anti-inflammatory, Antioxidant, Gastro protective, Hepatoprotective, Anti-microbial**
	MESHASHRINGI	Gymnema sylvestre	**Leaves- GS4- Regeneration / Repairement of beta cells, raises insulin levels in the serum**
	TINISHA KUCHANDANA CHANDANA (explained earlier)	**Ougenia oojeinensis** **Pterocarpus santalinus**	**Potentiating the insulin effect of plasma by increasing either the pancreatic secretion of insulin or by its release from the bound form**

	SHIMSHIPA	Dalbergia sissoo	**Radical scavenging effect, antioxidant effect-protection of pancreas , repairs beta cells**
	SHIRISHA	Albizzia lebbeck	**Dichloromethane-Decrease in FBS, Glycated haemoglobin, enhances plasma insulin level,** **Antioxidant, Hepato protective, Renal and cardio protective**
	ASANA	Pterocarpus marsuppium	**Heart wood- chloroform, hexane ad butanol- Insulin metabolism**
	DHAVA ARJUNA(explained earlier)	Anogeissus latifolia	**Anti-diabetic ,anti-hyperlipidemia and antioxidant effects in type 2 DM – Reduces Blood glucose levels**
	TALASHAAKA NAKTAMALA(explained earlier)	Borassus flabellifer	**Alcoholic (ALEBF) extract-Inhibits increase in blood glucose level, improves glucose tolerance and reduces insulin levels.**
	POOTIKA-CHIRABILWA	Holoptelea campestris	**Reduces FBS and PPBS**
	ASHWAKARNA AGURU, KALIYAKA (explained earlier)	Dipterocarpus turbinatus	**Ethanol- Mild effects on Anti diabetic activity- Reducing blood glucose levels.**
	ASHWATHA	Ficus religiosa	**Increase serum insulin, regulates liver glycogen and weight metabolism**

02. HARIDRA MEHA	RAJAVRUKSHA-ARAGWADHA (explained earlier)		
03. AMLA MEHA	NYAGRODHADI KASHAYA NYAGRODHA	Ficus bengalensis	**Betacytotropic efffect- enhances cytoplasmic granulationin the beta cell, reduces blood glucose levels**
	UDUMBARA ASHWATHA(explained earlier)	Ficus racemosa	**Acts on insulin mechanism**
	PLAKSHA	Ficus virens	**Regulation of blood glucose levels and insulin metabolism**
	MADHUKA	Glycyrrhiza glabra	**Liquorices-Inhibition of alpha glucosidase, alpha amylase-Reduction in disaccharide hydrolysis-Glycemic index control**
	KAPITANA-PARISHA KAKUBHA(explained earlier)	Thespesia populnea	**Bark, leaf, fruit, seed- Enhances cellular antioxidant defenses- Increases peripheral glucose uptake, Increases pancreatic secretion of insulin**
	AMRA	Mangifera indica	**Kernel- Decreases FBS, Regulates Hepatic glycogen, glycosylated hemoglobin, hepatic and pancreatic malonaldehyde**
	KOSHAMRA	Schleichera trijuga	**Reduces blood glucose levels**
	CHORAKAPATRA	Angelica glauca	**Reduces FBS , Ameliorates abnormal fasting serum insulin (FINS)**

	JAMBUDWAYA	Syzygium cumini	**Antiglycation potential**
	PRIYALA	Buchanania latifolia	**Glycosides, sterol- Reduces FBS, increase the serum level of glucose, Antioxidant, Anti hyperlypidemic**
	MADHOOKA	Madhuca indica	**Bark-Stimulation of glucose utilization by peripheral tissues.**
	ROHINI	Picrorhiza kurroa	**Reduces blood glucose, glycosylated haemoglobin, increases total haemoglobin, plasma insulin. Significantly corrects superoxide radicals, lipid peroxidation.**
	VANJULA	Salix caprea	**Methanol- Reduction in Blood glucose levels (PPBS and FBS)**
	KADAMBA	Anthocephalus indicus	**Decreases blood sugar levels and rectifies fatigue and irritation**
	BADARA	Ziziphus jujube	**Attenuates glucose induced neurotoxicity in diabetic neuropathy by decreasing high glucose induced cell toxicity, prevents Caspase 3 activation and excited ROS stimulation**
	TINDUKA	Diospyros peregrine	**Flavonoids and methanol- Alleviates augmented oxidative state associated with DM, reduces FBS**
	SALLAKI	Boswellia serrate	**Anti-diabetic activity by insulin metabolism regulation and prevents diabetes complications**

	RODHRA SAVARARODHRA	Symplocos racemosa	**Inhibits alpha amylase, alpha glucosidase , suppresses adipogenic activity**
	BHALLATAKA	Semicarpus anacardium	**Increases level of antioxidant enzymes, decreases levels of lipid peroxidation, Insulin metabolism**
	PALASHA	Butea monosperma	**Reduces blood glucose levels**
	NANDIVRUKSHA	Ficus arnottiana	**Acetone- Reduces FBS and PPBS-Anti diabetic activity**
04.KSHARA MEHA	TRIPHALA (explained earlier)		
05. MANJISHTA MEHA	MANJISHTA CHANDANA(explained earlier)	Rubia cordifolia	**Hypoglycemia- Reduces blood glucose levels, normalizes serum lipid , corrects hypo chromic microcytic anemia and loss of body weight**
06.SHONITA MEHA	GUDUCHI	Tinospora cordifolia	**Reduces hyperalgesia in case of Diabetic neuropathy**
	TINDUKA ASTHISAMHARAKA	Cissus quandrangularis	**Stem- Anti diabetic property by stimulation of surviving beta cell to release more insulin.**
	KASHMARYA	Gmelina arborea	**Regenerates Beta cell of pancreas, regulates serum lipids**
	KHARJURA	Phoenix	**Regulates beta cell of pancreas**

		sylvestre	

Vataja Meha

01.SARPI MEHA	**KUSHTA**	**Saussurea lappa**	Regulates liver glycogen, blood glucose and plasma insulin. Acts on thyroid gland, adrenal gland , pancreas and liver
	KUTAJA PATA(explained earlier)	Holarrhena antidysenterica	**Regulates carbohydrate metabolic enzymes such as glucose 6 phosphatase, anti hyperlypidemic**
	HINGU KATUROHINI, GUDUCHI, CHITRAKA (explained earlier)	Ferula narthex	**Preserves pancreatic beta cells integrity, Increases insulin secretion, prevent diabetic complications**
02.VASA MEHA **03.KSHOUDRA MEHA**	AGNIMANTHA, SHIMSHAPA (explained earlier) KADARA, KRAMUKA(explained earlier)		
04. HASTI MEHA	KAPITTHA TINDUKA, SHIRISHA, PALASHA, PATA(explained	Feronia elephantum	**Leaves and fruit- methyl chavicol- Decreases hepatic glucose production- Hypoglycemic activity**

	earlier)		
	MOORVA	Marsdenia tenacissima	**Reduces blood sugar levels, Antioxidative property**
	DUSPARSHA	Fagonia cretica	**Flavonoids, methanol, dipeptidyl peptidase 4- Insulin metabolism, anti hyperglycemic effect**
	HASTI ASTHI KSHARA	----------	**Collageous proteins- Hypoglycemic activity**
	ASHWA ASTHI KSHARA	----------	**Palmitic acid, Oleic acid and Lenoleic acid- Improves insulin sensitivity or glucose metabolism**
	SHOOKARA ASTHI KSHARA	----------	**Collagen, Proteins, insulin like growth factor-I in Pig's bone- Anti hyperglycemic activity by enhancing insulin metabolism.**
	KHARA ASTHI KSHARA	----------	**Collageous proteins- Hypoglycemic activity**
	USHTRA ASTHI KSHARA	----------	**Gelatin in Camel bone-Acute and rapid hypoglycemic effect**

Interpretation on applicability of above mentioned *Sushrutokta Vimshati Kashaya* in various stages of Diabetes Mellitus

1. **PRE DIABETES: Haridra Kashaya:** As it improves over all function of beta cells of pancreas and significantly lowers the development of Type 2 D.M. It also acts by improving the post prandial working memory in pre diabetes**.**

2. **DIABETES MELLITUS**
   a. **TYPE 1 D.M** with signs and symptoms of Polyuria, Polyphagia, Polydipsia, Weakness, Weight loss and restlessness: **Mrudwika Kashaya:** As it regulates beta cells of Pancreas and enhances strength and weight.
   b. **TYPE 2 D.M** with signs and symptoms of Polyuria, Polyphagia, Polydipsia and dyslipidemia: Kramuka Kashaya: As it restores all biochemical parameters, reduces FBS, reduces weight.

3. **Infections of D.M: Nimba Kashaya:** Improves expression of insulin signaling molecules and GLUT protein to enhance oxidation in skeletal muscle and also acts against infections.

4. **Diabetic Neuropathy, Nephropathy and Retinopathy: Triphala Kashaya:** Reduces FBS, PPBS, Restores functioning ability of beta cells of pancreas, Regulates Insulin metabolism and Anti-inflammatory.

5. **Sexual Dysfunction in D.M due to Stress: Doorva Kashaya**: Reduces FBS, Restores stress induced sexual dysfunction.

6. **Macro vascular complications of DM (Atherosclerotic changes)**: Badara Kashaya: Prevents Capase 3 activation and excited ROS stimulation, reduces oxidative stress and endothelial dysfunction.

DISCUSSION

Diabetes mellitus is increasing as years progresses due to various life style hazardous. Prevalence of globally is 422 million according to WHO and more than 62 million, which are more than 7.1% of adult population in India according to International Diabetes foundation. Achieving adequate glycemic control becomes a prime most factor in diabetes mellitus. Oral anti Diabetic drugs possess ample of side effects on almost all major systems of the body. *Ayurvedic* pharmacology emphasizes on adequate glycemic control as well as maintains individual's overall wellbeing by its holistic approach. *Acharya Sushruta's* contribution towards this increasing pandemic is tremendous. The up hand of *Kashaya yogas* in Diabetes Mellitus emphasized is interpreted as follows: 1. "*Prameha hetuh Kraphakrut cha Sarvam*. -*Cha.Chi*.6/4" *(Kapha* is the prime most affected *Dosha* in all kinds of Prameha and also all the causative factors point towards hampering *Kapha Dosha*) 2. Major *Doshas* affected in any kind of *Prameha* is *Meda* and *Mamsa* which has *Ashraya Ashrayee Bhava* with main culprit *Kapha Dosha-Cha.Chi* 6/5. 3. Aspect of *Shareeraja Kleda- Cha.Chi* 6/5. 4. *Sarvesham Pramehanam Sarvajatvam "*तत्र वातपित्तमेदोभिरन्वितः श्लेष्मा श्लेष्मप्रमेहाञ्जनयति, वातकफशोणितमेदोभिरन्वितं पित्तं पित्तप्रमेहान्, कफपित्तवसामज्जमेदोभिरन्वितो वायुर्वातप्रमेहान् ॥९॥ -सु.नि.६/९". Thus *Kashaya yogas* significantly plays a vital role in all types of diabetes Mellitus.

CONCLUSION

- The Diabetes mellitus has been emphasized under Prameha considering the Satmyata it possess. The *Sushrutokta Vimshati yoga* for *Vimshati Prameha* in a holistic way can be incorporated from the Pre Diabetic stage up to the prevention and management of complications of Diabetes mellitus.
- The *Yoga* mentioned by *Acharya Sushruta* achieve the goal of prevention, management, preventing and managing the complications of diabetes mellitus in a tremendous way due to their potential anti diabetic activity over the Oral anti diabetic drugs which possess ample of adverse effects. Thus, *Sushrutokta Vimshati yogas* regulates the Diabetes mellitus by its competent anti diabetic activity.

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