How can Ayurveda Contribute to Fighting Diabetes Mellitus?

Prof. G.G. Gangadharan
Ayurvedacharya, FAIP (USA), Ph.D., MoM (McGill)
Director
Ramaiah Indic Specialty Ayurveda Restoration Hospital
Gokula Education Foundation (Medical)
New BEL Road, MSR Nagar, Mathikere PO, Bengaluru – 560054, Karnataka, India
Email: vaidyaggganga@gmail.com

Diabetes mellitus (DM), ranked as one of the four principal non-communicable diseases (NCD), affects 422 million people worldwide (1) is the seventh leading cause of disability (GBD, 2015) and is directly responsible for 1.5 million deaths, with another 2 million attributed to related causes(2). The economic cost of DM, which includes cost of medical care and wage loss, has been estimated to be Intl$825 billion globally, with China ($170 billion), the USA ($105 billion), India ($73 billion), and Japan ($37 billion) bearing the brunt of the burden(1). The perception of individuals of 'healthcare' as extending beyond the mainstream allopathic system to encompass a wide range of traditional medical systems and complementary healthcare practices must be taken in to account when combating DM and other NCDs. Complementary and alternative medicine (CAM) use in DM is widespread, with Ayurveda being used by patients with estimated rates of 14% (3), 16.2% (4) and 40% (5) in India and 13.6% in Malaysia(6). 29.6% of users in one survey reported lowering of blood sugar with concomitant use of Ayurveda and Allopathy(4); however, it is difficult to evaluate the effect of Ayurveda per se and also raises questions about possible drug interactions. Few patients informed their Allopathic physician (29%)(3) or consulted them before starting CAM treatment (20%) (6). This suggests that allopathic physicians may benefit from knowing more about CAM systems such as Ayurveda.

The closest clinical correlate to DM in Ayurveda is the disease entity *Prameha*. The proposed etiologies of *Prameha,* i.e., aberrant genetic factors*(sahaja)*and unhealthy diet and lifestyle (*apathyanimittaja)* overlap considerably with modern medical theories of DM (7).Unhealthy lifestyle includes lack of physical and mental exercise and excessive daytime sleep. Overeating, alcohol abuse, excessive consumption of food that is heavy (*guru*), unctuous (*snigdha*), sour (*amla*) and salt (*lavana*), are unhealthy dietary habits in this context(7). Individuals with *prakriti* dominated by either *kaphadosha* (*kaphaprakriti*) or a combination of *vata*and *kaphadosha* (*vatakaphaprakriti*) are considered at greater risk of *Prameha*(7). This hypothesis is supported by correlation of these prakriti types with risk factors for cardiac disease like insulin resistance, insulin resistance, cytokine (IL6) and inflammatory markers (8). *Kaphaprakriti* is significantly correlated with BMI (9) and high levels of triglyceride, total cholesterol, VLDL and low levels of HDL(10). Recent evidence supports a genetic basis for various *prakriti* types and differential disease susceptibility. 52 single nucleotide polymorphisms have been identified that significantly differentiate between *kapha, vata* and *pitta prakriti*(11). More specifically, *kapha prakriti* shows a strong correlation with 34 unique regions of DNA methylation and high BMI simultaneously (12) and CYP2C19 gene polymorphism associated with slow metabolism of various drugs (13). This is particularly relevant to the central role of metabolism (*agni*) in *Prameha*according to Ayurveda; a sub-optimal *agni* leads to nutritional aberration at the tissue (*dhatu*) level, progressively affecting the nourishment of multiple tissues (*dhatukshaya*) in due course (14,15)

The multifactorial approach to disease conceptualization in Ayurveda coupled with the fundamental therapeutic principle of restoring balance between the *dosha*(homeostasis) results in a multi-component management strategy including pharmacotherapeutics, systemic cleansing (*shodhanachikitsa),* dietary and lifestyle modification. The goals of treatment in Ayurveda are *apunarbhavatva*, or achieving homeostasis that does not relapse to the prior diseased stage (non-recurring) and *yonyamanyamudeerayet*, or achieving homeostasis without causing any disturbance to any other systems or without side-effects(7). Treatment of DM is customized based on *prakriti* (constitution) and disease stage. Dietary modification is an essential component of clinical management; further it is strongly recommended for prevention of *Prameha.*For example, ensuring optimal nutrition and mild exercise is the focus for patients of lean build *(krisha),* while cleansing and weight loss via light yet nutritious diet and vigorous exercise are prescribed for overweight or obese *(sthula)* patients (7). Portion size and number of meals are to be tailored to individuals' *Agni* (metabolic capacity).

Commonly prescribed dietary items include cereals like barley*(Hordeum vulgare*L.), wheat (*Triticum aestivum*) and aged rice (*Oryza sativa);*pulses like green gram*(Vigna radiata)*, bengal gram*(Cicer arietinum*), horse gram *(Macrotyloma uniflorum*); vegetables like bitter gourd *(Momordica charantia);* fenugreek (*Trigonella foenum-graecum)*, snake gourd (*Trichosanthes cucumerina)*; garlic (*Allium sativum* Linn); fruits like Java plum *(Syzygium cumini);* Indian gooseberry *(Phyllanthus emblica*), wood apple *(Limonia acidissima*), date palm (*Phoenix sylvestris*) and Indian fig*(Ficus racemosa* L.);meat of animals like deer and rabbit and birds like pigeon and partridge and aged wine (15,16).A number of herbs prescribed in Ayurveda for DM have anti-hyperglycaemic, anti-hyperlipidemic, anti-oxidant, insulin-sensitizing and pancreatic beta cell regenerative activity, demonstrated using in vivo and in vitro models of diabetes mellitus. These include *Guduchi* (*Tinospora cordifolia*)(17,18), *Jambu* (*Euginia jambolana*) (19), *Aswattha* (*Ficus religiosa)* (20), *Bijasara* (*Pterocarpus marsupium)* (21), *Apamarga* (*Achyranthes aspera*) (22), *Patraka* (*Cinnamomum tamala*) (23), *Karavellaka* (*Momordica charantia*) (24), *Gudmar* (*Gymnema sylvestre*) (25), *Palandu* (*Allium cepa*) (26), *Mamejjak* (*Enicostemmalittorale*) (27), *Lasuna* (*Allium sativum*) (28), *Daruharidra* (*Berberis aristata)* (29); *Bimbi* (*Coccinia indica)* (23) and *Nipava* (*Cyamopsistetragonoloba*) (23).

However, clinical trials have predominantly tested proprietary, polyherbal preparations rather than medicines or treatment regimens used in routine clinical practice. Significant reductions in glycosylated hemoglobin (HbA_1C), fasting and post-prandial blood glucose have been demonstrated for several preparations(30–32). But, the results are undermined by methodological weaknesses, such as inadequate sample size and lack of proper randomization and allocation concealment (33). Despite common usage of Ayurveda simultaneously with allopathy, there has been very little research on integrative clinical care. A randomized, double-blind placebo-controlled crossover study found that addition of a polyherbal tea containing *Pterocarpus marsupium*Roxb., *Salacia reticulata* Wight, *Cinnamomum zeylonicum* Blume, *Artocarpus heterophyllus* Lam and *Tinospora cordifolia (Willd.)* Hook F&Thoms for 3 months to a standard regimen of glibenclamide significantly improved glycemic control with few and mild gastrointestinal side-effects(34). It is important to note that these studies evaluated the efficacy of a single pill or tonic rather than 'whole-system Ayurveda', i.e., the customary practice of following an entire regimen of internal and external medications, diet, exercise and other interventions, customized to individual patients. A very preliminary investigation of a modified form of whole-system Ayurveda, adding diet, exercise and meditation according to principles of Ayurveda to a single polyherbal pill has shown limited benefit in patients with high baseline HbA_1C, indicating the need for further study(35).

In summary, Ayurveda has a well-developed conceptual framework of DM that incorporates diet and lifestyle as causative factors and a multifactorial approach to management. While there is evidence from preclinical studies to support the proposed actions of many herbs, clinical trials are few. Ayurveda also has prescriptions for prevention of diabetes mellitus, which have received little attention. The holistic approach of Ayurveda, which includes medication, diet and exercise regimens seems well-suited to the management of lifestyle disorders such as DM. While there is increasing understanding of the mechanisms of action of several herbs used in Ayurveda, there is very little clinical research on the efficacy and safety of Ayurveda management. Given the national and international focus on mainstreaming traditional systems, further research is urgently required. The overall clinical effect of whole system treatment regimen as well as potential interactions with allopathic medicines should be investigated. Outcomes should include biochemical parameters, psychological well-being, ability to achieve and maintain changes in diet and cost-effectiveness. Prevention of disease and maintenance of health that are critical management strategies in Ayurveda and other traditional medicine systems are also valuable areas of exploration, given the vital need to arrest the rapid increase in NCD prevalence. Finally, patients with DM are already practicing integrative medicine; this behooves medical practitioners of all systems to develop safe, evidence-based models of integrative care for the benefit of society.

References

1. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. Lancet. 2016 Apr;387(10027):1513–30.

2. World Health Organization. Global Report on Diabetes. 2016;

3. Bhalerao MS, Bolshete PM, Swar BD, Bangera TA, Kolhe VR, Tambe MJ, et al. Use of and satisfaction with complementary and alternative medicine in four chronic diseases: a cross-sectional study from India. Natl Med J India. 26(2):75–8.

4. Kumar D, Bajaj S, Mehrotra R. Knowledge, attitude and practice of complementary and alternative medicines for diabetes. Public Health. 2006 Aug;120(8):705–11.

5. Chacko E. Culture and therapy: complementary strategies for the treatment of type-2 diabetes in an urban setting in Kerala, India. Soc Sci Med. 2003 Mar;56(5):1087–98.

6. Huri HZ, Lian GTP, Hussain S, Pendek R, Widodo RT. A survey amongst Complementary Alternative Medicine (CAM) users with type 2 diabetes. Int J Diabetes Metab. 2009;17(1):9–15.

7. Charaka, Drdhabala, Chakrapanidatta. The Charaka samhita of Agnivesha. Varanasi: Munshiram Manoharlal Publishers Pvt. Ltd; 1992.

8. Mahalle NP, Kulkarni M V, Pendse NM, Naik SS. Association of constitutional type of Ayurveda with cardiovascular risk factors, inflammatory markers and insulin resistance. J Ayurveda Integr Med. 2012 Jul;3(3):150–7.

9. Rotti H, Raval R, Anchan S, Bellampalli R, Bhale S, Bharadwaj R, et al. Determinants of prakriti, the human constitution types of Indian traditional medicine and its correlation with contemporary science. J Ayurveda Integr Med. 2014 Jul;5(3):167–75.

10. Prasher B, Negi S, Aggarwal S, Mandal AK, Sethi TP, Deshmukh SR, et al. Whole genome expression and biochemical correlates of extreme constitutional types defined in Ayurveda. J Transl Med [Internet]. 2008;6(1):48. Available from:

http://www.translational-medicine.com/content/6/1/48

11. Govindaraj P, Nizamuddin S, Sharath A, Jyothi V, Rotti H, Raval R, et al. Genome-wide analysis correlates Ayurveda Prakriti. Sci Rep [Internet]. 2015;5:15786. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4625161&tool=pmcentrez & rendertype=abstract

12. Rotti H, Mallya S, Kabekkodu SP, Chakrabarty S, Bhale S, Bharadwaj R, et al. DNA methylation analysis of phenotype specific stratified Indian population. J Transl Med. 2015 May;13:151.

13. Ghodke Y, Joshi K, Patwardhan B. Traditional Medicine to Modern Pharmacogenomics: Ayurveda Prakriti Type and CYP2C19 Gene Polymorphism Associated with the Metabolic Variability. Evid Based Complement Alternat Med. 2011;2011:249528.

14. Madhava. Madhava Nidanam (Roga Viniscaya) of Madhavakara: A Treatise on Ayurveda. Varanasi: Chaukhambha Orientalia; 2013.

15. Sushruta, Dalhanacharya, Gayadasacharya. Sushruta samhita. Varanasi: Krishnadas Academy; 1998.

16. Babu M.S. S. Yoga ratnakara. Varanasi: Chowkhambha Sanskrit Series Office; 2006.

17. Stanely P, Prince M, Menon VP. Hypoglycaemic and other related actions of Tinospora cordifolia roots in alloxan-induced diabetic rats. J Ethnopharmacol. 2000 Apr;70(1):9–15.

18. Kalekar SA, Munshi RP, Thatte UM. Do plants mediate their anti-diabetic effects through anti-oxidant and anti-apoptotic actions? an in vitro assay of 3 Indian medicinal plants. BMC Complement Altern Med. 2013;13:257.

19. Ravi K, Ramachandran B, Subramanian S. Protective effect of Eugenia jambolana seed kernel on tissue antioxidants in streptozotocin-induced diabetic rats. Biol Pharm Bull. 2004 Aug;27(8):1212–7.

20. Pandit R, Phadke A, Jagtap A. Antidiabetic effect of Ficus religiosa extract in streptozotocin-induced diabetic rats. J Ethnopharmacol. 2010 Mar;128(2):462–6.

21. Vats V, Grover JK, Rathi SS. Evaluation of anti-hyperglycemic and hypoglycemic effect of Trigonella foenum-graecum Linn, Ocimum sanctum Linn and Pterocarpus marsupium Linn in normal and alloxanized diabetic rats. J Ethnopharmacol. 2002 Jan;79(1):95–100.

22. Akhtar MS, Iqbal J. Evaluation of the hypoglycaemic effect of Achyranthes aspera in normal and alloxan-diabetic rabbits. J Ethnopharmacol. 1991 Jan;31(1):49–57.

23. Kar A, Choudhary BK, Bandyopadhyay NG. Comparative evaluation of hypoglycaemic activity of some Indian medicinal plants in alloxan diabetic rats. J Ethnopharmacol. 2003 Jan;84(1):105–8.

24. Leatherdale BA, Panesar RK, Singh G, Atkins TW, Bailey CJ, Bignell AH. Improvement in glucose tolerance due to Momordica charantia (karela). Br Med J (Clin Res Ed). 1981 Jun;282(6279):1823–4.

25. Ahmed ABA, Rao AS, Rao M V. In vitro callus and in vivo leaf extract of Gymnema sylvestre stimulate a-cells regeneration and anti-diabetic activity in Wistar rats. Phytomedicine. 2010 Nov;17(13):1033–9.

26. Kumari K, Augusti KT. Antidiabetic and antioxidant effects of S-methyl cysteine sulfoxide isolated from onions (Allium cepa Linn) as compared to standard drugs in alloxan diabetic rats.

Indian J Exp Biol. 2002 Sep;40(9):1005–9.

27. Murali B, Upadhyaya UM, Goyal RK. Effect of chronic treatment with Enicostemma littorale in non-insulin-dependent diabetic (NIDDM) rats. J Ethnopharmacol. 2002 Jul;81(2):199–204.

28. Eidi A, Eidi M, Esmaeili E. Antidiabetic effect of garlic (Allium sativum L.) in normal and streptozotocin-induced diabetic rats. Phytomedicine. 2006 Nov;13(9–10):624–9.

29. Singh J, Kakkar P. Antihyperglycemic and antioxidant effect of Berberis aristata root extract and its role in regulating carbohydrate metabolism in diabetic rats. J Ethnopharmacol. 2009 May;123(1):22–6.

30. Agrawal RP, Sharma A, Dua AS, Chandershekhar, Kochar DK, Kothari RP. A randomized placebo controlled trial of Inolter (herbal product) in the treatment of type 2 diabetes. J Assoc Physicians India. 2002 Mar;50:391–3.

31. Mohan V. Evaluation of Diabecon (D-400) as an Antidiabetic Agent - A Double-Blind Placebo-Controlled Trial in NIDDM Patients with Secondary Failure to Oral Drugs. Indian J Clin Pract. 1998;8(9):18.

32. Shekhar KC, Achike FI, Kaur G, Kumar P, Hashim R. A preliminary evaluation of the efficacy and safety of Cogent db (an ayurvedic drug) in the glycemic control of patients with type 2-diabetes. J Altern Complement Med. 2002 Aug;8(4):445–57.

33. Sridharan K, Mohan R, Ramaratnam S, Panneerselvam D. Ayurvedic treatments for diabetes mellitus. Cochrane database Syst Rev. 2011;(12):CD008288.

34. Jayawardena MHS, de Alwis NMW, Hettigoda V, Fernando DJS. A double blind randomised placebo controlled cross over study of a herbal preparation containing Salacia reticulata in the treatment of type 2 diabetes. J Ethnopharmacol. 2005 Feb;97(2):215–8.

35. Elder C, Aickin M, Bauer V, Cairns J, Vuckovic N. Randomized trial of a whole-system ayurvedic protocol for type 2 diabetes. Altern Ther Health Med. 12(5):24–30.

Source of Support : Nil
Conflict of Interest : None