

2.0 LITERARY RESEARCH - REVIEW OF ANCIENT LITERATURE ON T2D, OXIDATIVE STRESS, DNA DAMAGE AND YOGA

2.1 BACKGROUND AND SCOPE

Type-2 diabetes (T2D), one of the fastest-growing lifestyle diseases is also considered a major risk factor for many other life-threatening complications. As mentioned in the introduction, T2D is also known to be associated with high oxidative stress because of the increased production of reactive oxygen species and subdued antioxidant capacity. Finding better treatment methods that are affordable and available becomes important in its management. India, with its rich tradition in medicinal systems and philosophy, has the potential to immensely contribute towards tackling the onward menace of T2D.

Āyurveda, the ancient system of medicine that is widely practiced in India views health in more holistic terms and recommends more on prevention than cure for maintaining better health. *Yoga*, a philosophical system with a strong emphasis on mental and physical discipline, that had its mainstay in the life of spiritual aspirants of various philosophical systems in earlier times, finds its way into the life of ordinary people who seek better health, as evident from its worldwide popularity in recent times. Both *āyurveda* and *yoga*, which originated millenniums before in the rich cultural past of India, give importance to the wellbeing of one's physical, mental, spiritual, and social aspects for attaining sound health. As unhealthy lifestyle is considered as a major causative factor in the genesis of T2D, it will be interesting to ascertain the views of these systems in their management.

In this study, we would like to elucidate how ancient knowledge systems of India perceive a lifestyle disease like T2D, particularly *āyurveda*, drawing parallels in its concepts and examine similarities in its approaches with the modern understanding in its management. In the same line, we also examine the understanding of lifestyle diseases in the *yoga* tradition, both from the philosophical and practical point of view, along with its management.

2.2 SUMMARY OF EARLIER WORKS ON T2D, OXIDATIVE STRESS, DNA DAMAGE AND YOGA

Various studies involving yoga for the management of T2D observed multiple benefits for the practitioners. Gordon et al. observed that yoga practice help T2D patients in improving lipid levels, body composition, reduce oxidative stress and increase antioxidant capacity (Gordon et al., 2008). Nagarathna et al. study reported improvement in blood glucose, lipid profile, and reduction in medication for the yoga group compared to exercise group in an RCT (Nagarathna et al., 2012). Singh et al. observed yoga practices can bestow better control on blood glucose, lipid, and insulin levels in T2D subjects (Singh et al., 2008). Another RCT with yoga intervention reported weight reduction, reduction in waist circumference, and improvement in psychological well-being in T2D subjects (McDermott et al., 2014). Thind et al. in the systematic review observed reduction in waist-hip ratio, blood pressure control and better glyceemic, lipid profile outcomes in T2D subjects (Thind et al., 2017). In a review, Bisht et al. observed that yoga interventions reduce oxidative stress and DNA damage in sperm cells (Bisht et al., 2017). Hegde et al. reported reduction of oxidative stress in T2D subjects who practiced yoga (Hegde et al., 2019).

2.3 AIMS AND OBJECTIVES

Aim of this literary research is to ascertain the concept and management of lifestyle disease like T2D in our ancient systems like *āyurveda* and *yoga*.

Objectives of study are;

-) To understand *āyurveda's* views on the etiopathology of T2D and its management from a lifestyle's perspective
-) To understand *yoga's* views on the origin of lifestyle diseases like T2D and its management

2.4 MATERIALS AND METHODS

2.4.1 - VEDIC SOURCES AND CLASSICAL YOGIC TEXTS INCLUDES:

Āyurveda texts like *Caraka saḥita*, *Çuçruta saḥita*, *Aññāiga hādaya*; philosophical texts like *Kaöopaniñat*, *Yoga Vaññöha*, *Patanjali yoga sutra*, *Bhagavat Géta*; and *Haöhayoga pradépika* for yoga practices were referred for the ancient literary research in this study

2.4.2 - METHODS

In this literary research we looked for concepts of lifestyle diseases and their management written in ancient classical texts of *Āyurveda* and *Yoga*. *Āyurveda* texts were examined for etio-pathological links to T2D and concepts similar to oxidative stress in modern understanding, and approaches in the management of T2D from a lifestyle's perspective. On similar lines, *Yoga* texts dealing with the underlying philosophy in the concept of origin of lifestyle disease and management were referred to and compiled for this research.

T2D and importance of lifestyle in its management; perspectives from *Āyurveda*

Āyurveda, one of the world's oldest systems of medicine, originated and practiced in India for millenniums, termed excessive production of urine and related symptoms like that of diabetes

as *prameha*, which when not treated well leads to a condition termed *madhumeha*. *Āyurveda* emphasizes the importance of maintaining a healthy lifestyle to achieve better health and considers inappropriate lifestyle and behavior as factors that contribute to the development of *prameha*

Etiology of *prameha* according to *āyurveda*

AaSyasuo< Svβsuo< dxlin caMyaEdkanuprsa> pya<is,
nvaÚpan< gufvEk«t< c àmehhetu> k)k«½ svRm! .

*äsyäsukhaà svapnasukhaà dadhéni grāmyaudakānuparasāu payāsi |
navānnapānā guḍavaikātaà ca pramehahetuū kaphakācca sarvam ||*

(Caraka saàhita _Cikitsasthāna 6 / 4)

Meaning: Over-indulgence in the pleasure of sedentary habits, excess sleep, curds, soup of the meat of domesticated and aquatic animals and animals inhabiting marshy land, milk and its preparations, freshly harvested food articles, freshly prepared drinks, preparations of jaggery and all *kapha*- aggravating factors are responsible for the causation of *prameha*.

idvSvβaVvyamalSyàs' < zltiōGxmxurmeXyŌvaŪpanseivn< pué;< jinyat! àmeih Éiv:ytlit.
*divasvapnāvvyayāmālasyaprasaktaà çéṭasnigdhamadhuramedhyadravānnpānasevinaà
puruñāà janiyāt pramehi bhaviñyatēti ||*

(Çuçruta saàhita sūtranidana: 6 / 3)

Meaning: Indulgence in day sleep, lack of exercise, sedentary life style, cold, unctus, fatty, and sweet food etc are mentioned as the causative factors of *prameha*.

According to *āyurveda*, health is a state of balance, where the *doñas*(three fundamental bodily bio-elements) are in a balanced state.

raejStu dae;vE;<y< dae;saMymraegta,
rojastu doñavaiñāyāà doñasāmyamarogātā |

(Aññāiga hādayāà _sūtrasthāna: 1 / 20)

Meaning: The above sloka describes the importance of *doñas* in the body, as it says that all the diseases are due to vitiation or imbalance in these three *doñas*, while the health is a result of the balance of the same.

It also considers that the physical body is made up of seven types of tissues termed *dhätus*, and imbalances in *doñascan* affect the *dhätus*.

ivkrae xatuvE;<y< saMy< àk«itéCyte,
vikaro dhätuvaiñàyaà sämyaà prakâtirucyate |

(Caraka saàhita sùtrasthàna: 9/4)

Caraka explains the importance of the *dhätus* by stating that the diseases are resultant of the dysfunction and imbalance of *dhätus* and that a normal state of health is achieved by balanced functional *dhätus*.

Further it explains about the imbalances happening in the *dhätus* in *prameha* conditions.

Imbalances of *dhätu* in *prameha*

medí ma<s< c zrlrj< c
-ed< k)ae bisgt< àË:y kraeit mehan!,
medaçca mäàsaà ca çarérajaà ca
kledaà kapho bsigataà pradüñya karoti mehàna/

(Caraka saàhita_Cikitsasthàna : 6 / 5)

Meaning: Disturbed state equilibrium in *mēda dhātu*, *māsadhātu* and *kapha doñaca* causes the disease *prameha*.

Concepts similar to the effect of metabolic dysfunction, free radicals and oxidative stress on tissues and cells in *Āyurveda*

Āyurveda considers that improper digestion leads to the production of *āma*, which in modern parlance can be termed as endotoxins, a product of improper metabolism at the systemic or cellular level; if not neutralized or removed, can lead to pathological conditions.

^:m[aeLpblTven xatumaXympaictm!,
Êòmamazygt< rsmam< àc]te.

*üñmaëolpabalatvena dhätumädhyamapäcitam |
duñöamämäçayagataà rasamämaà pracakñate ||*

(Añöäiga hādayaà _sūtrasthāna: 13/25)

Meaning: The first tissue of the body *dhātu*, which was not formed properly due to the weakness of the digestive fire and accumulating in the stomach in an abnormal state, is known as *āma*.

ANye dae;e_y @vait Êòe_yae=Nyae=NymUCDRnat!,
kaeÔve_yae iv;Sye v dNTyamSy sMÉvm!.

*anye doñebhya evāti duñöebhyo'onyo'nyamürccchanät |
kodravebhyo viñasyeva vadantyämasya sambhavam ||*

(Añöäiga hādayaà _sūtrasthāna: 13/26)

Meaning: Some experts opine that *āma* gets formed from intimate mixing of vitiated *doñas* with one another just as the poison is formed from mixing of different kinds of *kodrava* (a class of grains).

Further, *Vāgbhaöcärya* explains how improper metabolism is leading to disease conditions.

Aamen ten sMp&´a dae;a È:yaíËi;ta>,
sama #TyupidZyNte ye c raegaStËÑva>.

ämena tena sampåktä doñä düñyåçcadüñitäu |
sämä ityupadiçyante ye ca rogästadüdbhaväu ||

(Añöäiga hådayaà_sütrasthäna: 13/27)

Meaning: When the *doñas* and *düñyas* are mixed with the *äma*, they can be called *säma doña* (or) *säma düñya*, which are the causes of the diseases.

As a result of *agni mändya*, *äma* is formed and it enters the pathways in the body called *strotas*, block them and vitiate the functions of various *dhätus* or tissues. Hence the concept of *agni mändya* and *äma* can be correlated with metabolic dysfunction, ROS, and oxidative stress.

In T2D (*prameha / madhumeha*) conditions also, *kleda*, is a form of *äma*, which is responsible for vitiating the *doñas*. In modern terms, hyperglycaemic condition associated with T2D increases the plasma protein glycation products and thereby increases the ROS and decreases the antioxidant capacity. Oxidative stress thus formed can lead to cellular injury via the peroxidation of membrane lipids and oxidative damage of proteins and DNA.

Management of *prameha* through lifestyle modification as recommended by *Āyurveda*

VyayamyaejEivRivwE> àgaFEéÖtRnE> öanjlavsekE>,
seVyTvjaeljuécNdnaXyEivRlepñEíazu n siNt meha>.

vyäyämajairvivithaiù pragàhairudvartanaiù snänajälävasekaiù |
sevyatvajolajurucandanädhyairvilepanaiçcäçu na santi mehäu ||

(Caraka saàhita_cikitsasthäna: 6 / 50)

Meaning: *Prameha* get immediately cured by different types of exercises, unction, bath, sprinkling of water over the body and application of ointment made of *sevyä, tvak, ela, aguru, chandana* etc

äv&ïmehaStu Vyayaminuyü³IfagjiturgrwpdaitcyaRpir³m[aNyôaeparôe pravâddhamehästu

pravâddhamehästu

vyäyämniyuddhakréòägajaturagarathapadäticaryäprikramaëänyastropärastre
parävabhñadadahämehabrasatu

(Çuçruta saàhita_cikitsasthäna: 11 / 11)

Meaning: The practice of regular physical exercise, wrestling, active sports, riding on a horse or an elephant, long walks, pedestal journeys, practicing archery, casting of javelins, etc., should be resorted to in a case where the disease has made a decided advance.

Hence is it clear that, various *Āyurveda* texts emphasize the importance of lifestyle changes along with medication in the treatment of *prameha*, as wrong lifestyle is considered as the main cause of the disease.

Yoga, the concept of lifestyle disease and its management:

According to *Yoga Vañiñöha*, the pathophysiology of lifestyle disease is defined as *ädhija-vyädhi* or disturbances (*ädhi/* stress) at the *manomaya koça* (mind), that manifest as *vyädhis* (diseases) in the *annamaya koça* (physical body), percolating through affected *präëa*(vital energy) in the *präëamaya koça* (energy body). In the following verses it establishes the connections and relationship between mind, vital energy and the body.

icÄe ivxuirte deh> s<]aeÉnuYTylm!,
twaih éi;tae jNturčmev n pZyit.
citte vidhurite dehaù saikñobhanuyatyalam |
tathähi ruñito janturagrameva na paçyati ||

(Yoga Vañiñöha: 6.2.30)

Meaning: The mind being disturbed by anxieties the body is disordered also in its functions, as the man that is overtaken by anger, loses the sight of whatever is present before his eyes.

Asm< vhit à[e nq(ae yaiNt ivs<iSwitm!,
AsMyKs<iSwte ÉUpe ywa v[Rim³ma>.
asamaà vahati praëe naöyo yänti visaàsthitim |
asamyaksaàsthite bhüpe yathä varëaçramakramäù ||

(Yoga Vañiñöha: 6.2.33)

Meaning: Vital airs breathing irregularly, derange the lungs and nerves and all the veins and arteries of the body; as the misrule in the government, puts the laws of the realm into disorder.

k...j|[RTvmj|[RTvmitj|[RTvmev va,
dae;ayEv àyaTyÚ< à[s<carÉ:³œmat!.
kujérëatvamajérëatvamatijérëatvameva vä |
doñäyaiva prayätyannaà praëasaicäraduñkrmät ||

(Yoga Vañiñöha: 6.2.35)

Meaning: Because of this corrupt flow of prana, the indigest food will take to wrong course (it turns into poison), and there will be incorrect digestion/metabolism, indigestion, and excessive digestion. (Here, one can see a parallel with the concepts of *äma* explained in *Äyurvedatexts*)

Definitions of Yoga in various texts:

Yoga, though fundamentally being a philosophical system, its emphasis on the discipline of body and mind practices for spiritual growth was employed by many for maintaining better health, as well as in the therapeutic field for treating various kinds of diseases. Though different classical texts define yoga in various ways, the underlying theme in all of their definitions is mental discipline.

Yoga Vañiñöh defines *yoga* as a tactful method to calm the mind

mn> à!îmnaepay> yaeg #TyiÉixyt!,
manaù prçnamanopäyaù yoga ityabhidhiyat |

(Yoga Vañiñöha: 3.9.32)

Kaöopaniñat states that yoga is a state of mastery over the senses, and mind.

ta< yaegimit mNyNte iSwrimiÔyxr[am!
tää yogamiti manyante sthiramidriyadharaëäm

(Kaöopaniñat: 2.5.4)

Sage *Patanjali* defines yoga as a state achieved through cessation of all mental modifications

yaegaiíÄv&iÄinraex>.
yogäçcittavâttinirodhaù ||

(Patanjali yoga sùtra 1 / 1)

In *Bhagavat géta*, yoga is defined as a state of equanimity as well as dexterity in action

smTv< yaeg %Cyte.
samatvaà yoga ucyate ||

yaeg> kmRsu kaEzlm!
yogaù karmasu kauçalam ||

(Bhagavat Géta 2 /48, 50)

T2D management using yogic practices and their benefits; a *Haöhayoga pradépikaview*

Āsana:

hQSy àwmaNgTvadasn< pUvRmuCyte,
k...yaRĀadasn< SWyEyRmaraeGy< ca<gla"vm!.

haöhasya prathamāngatvädāsanaà pūrvamucyate |
kuryättādāsanaà sthyairyamārogyaà cāḡalāghavam ||

(Haöhayoga pradépika 1:17)

Meaning: Prior to all, *āsana* is spoken of as the first part of *Haöhayoga*. By its practice one gets steadiness of body and mind; disease lessness and lightness of the limbs.

Präëyama:

cle vate cl< icÄ< iníle iníl< Évet!,
yaegl Swa[uTvmaßaeit ttae vayu< inraexyet!.

cale vāte calaà cittaà niçcale niçcalaà bhavet |
yogé sthāëutvamāpnoti tato vāyuà nirodhayet ||

(Haöhayoga pradépika 2:2)

Meaning: When the breath is unsteady, the mind is unsteady. When the breath is steady, the mind is steady, and the yogi becomes steady. Therefore, one should restrain the breath.

Benefit of *nāðhiçuddhi präëyama*

yweò<xar[< vayaernlSy àidpnm!,
ndiÉVyí raraeGy< jayte nifzaexnat!.

yatheñöandhāraëaà väyورانالاسيا pradipanam |
nadabhivyaktirārogyaà jāyate naðhiçodhanāt ||

(Haöhayoga pradépika 2:20)

Meaning: When one is able to hold the *vāyu* according to one's will, the digestive power increases. With the *nāðhis* purified, thus the inner sound or *nāda* awakens and one is free from disease.

Āsanas or specific postures thus help to tone the body and improve the physiological functions, vitality and steady the mind; while specific breathing techniques or *präëyama* steadies the flow of energy, helps to calm the mind and reduce physiological and mental

stress and there by improves the functions of the body. Hence, in multiple ways, yoga practices help improving the state of health in T2D subjects.

2.1 SUMMARY

From the insights that we have from the ancient texts, it is clear that the origin of lifestyle diseases like T2D is at the mental plane, as a result of combination of factors like stress, anxiety, depression and wrong understanding about life itself. These factors, along with sedentary lifestyle and food habits lead to manifestation of disease conditions in physical body. It is also evident that the wisdom from the ancient texts of *Āyurveda*, *Bhagavat gēta* or other *Yoga* texts, emphasize that notional correction about the life is an important requirement for better health or improvement from a disease condition. This leads to the changes in *āhāra* and *vihāra* or appropriate lifestyle changes, enabling one to regain health or better management of a disease like T2D, and practices like yoga can immensely contribute towards that.