CHAPTER – 1

INTRODUCTION

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1.1 DIABETES - DEFINITION AND EPIDEMIOLOGY

Type 2 Diabetes (T2DM) is currently a global epidemic. Rates of diabetes in 1985 were estimated at 30 million, increasing to 135 million in 1995. Today, 347 million people worldwide are estimated to have diabetes. As of 2010, the five countries with the greatest prevalence of diabetes were, China, 92 million; United States, 32 million; India, 30 million; Japan, 10 million; and Indonesia, 7 million. (WHO, 2014) By 2030, India will have 80 million. (WHO, 2014). These increases are believed to be primarily due to global population aging, decreased exercise, and increasing rates of obesity. (WHO, 2013). According to the most recent estimates, the worldwide prevalence of diabetes mellitus for all age groups is set to increase from 2.8% in 2000 to 4.4% in 2030. This would represent a staggering 366 million diabetics worldwide in 2030. (Wild S, et. al. Roglic G, et. al. 2004).

The need for effective programs against diabetes is very great. An estimate of global prevalence of diabetes for 2010 and 2030 (Shaw JE, Sicree R.A., et al.2010) using studies of 20-79 year olds from 91 countries, projected the 2010 world prevalence of 285 million (6.45%) to increase to 439 million (7.7%) in 2030, a 69% increase in developing countries and 20% in developed countries. The Global Diabetes Atlas 2012 (IDF, 2012) however, estimated that numbers had already risen to **371 million** people in 2013, and would rise to **552 million** by 2030. In 2011, Diabetes healthcare expenditures were **11% of total healthcare expenditures** for 20 to 79 year olds, and cost **US$ 465 billion**. The Diabetes Atlas 2006 estimated the number of people with diabetes in India in 2006 at 40.9 million, projecting it would rise to 69.9 million by 2025. However, it is already 61 million, far ahead of schedule. (Roglic, G. 2016)

In 2004, an estimated 3.4 million people died from consequences of high fasting blood sugar. (WHO, 2013) More than 80% of diabetes deaths occur in low- and middle-income countries.

WHO projects that by 2030 T2DM will be the 7th leading cause of death. Healthy diet, regular physical activity, maintaining normal body weight, and avoiding tobacco use can prevent or delay its onset. (WHO, 2013).

Identifying a good system of prevention for diabetes is of the highest importance to public health. Improving current biomedical methods of treatment is highly desirable. The preferred drug, metformin, has serious long-term side effects (Owen M, Doran E, et al. 2000), compromising the health of the patient, particularly the liver. Indian systems of medicine such as *Yoga* and *Āyurveda* offer their own approach to treating T2DM, avoiding use of drugs like metformin. The evidence base for their efficacy is quite well established and studies continue. Numbers of studies have been performed on both *Yoga* and *Āyurveda,* & are reviewed in Chapter 3.

In the city of *Bhopāl*, I have established five *Rasāhāra Kendra*, Yoga and *Āyurveda* based herbal juice clinics. These adopt an integrated approach to treating patients with many pathologies including *Sthaulya* (obesity), *Prameha* (frequent urination), and *Madhumeha* (T2DM), the most frequent, but not universal, sequence in which diabetes develops according to *Āyurveda* (*Caraka samhitā, trans. Śarmā P. V. Su.Ch.17,1998*). My uncle, *Vaidya PY Vaidya* in *Puṇe*, who in 2010 received the prestigious '***Śatābdi Maharishi Award***' from India's President, and ***National Dhanvantari Āyurveda Award***' in 2016, from the department of AYUSH, played a key role in helping establish the clinics' practice protocols. He particularly stresses the importance of *Doṣa prakriti* analysis of the patient as the best diagnostic basis for determining treatment; also the need to know any drugs the patient has been taking and side effects they have experienced. For diabetics, he emphasizes the importance of daily routine and the need to maintain regular meal times, as well as appropriate foods.

Many patients have attended the clinics since they started in 2006. Annual figures recorded from the starting date to the same date the following year are given in Table 1.1.

Table 1.1: New Patients Attending *Rasāhāra Kendra* (Herbal Juice Clinics) in Bhopal

Year of First Consultation	Number of patients (only partial data)	Number of patients (full data)
2006-2007	**125**	-
2007-2008	**146**	-
2008-2009	**6**	**108**
2009-2010	-	**110**
2010-2011	-	**150**
2011-2012	-	**69**
2012-2013	-	**322**
2013-2014	-	**319**
2014-2015	-	**210**
2015-2016	**28**	**320**
2016-2017	**40**	**230**
Totals	**345**	**1838**
GRAND TOTAL		**2183**

Table1Caption: Table 1.1 shows total number of patients attended 5 Rasahara clinics in Bhopal, who's full record is kept.

Full records first started being kept early in 2008, when good results were being clearly obtained. All data analysis started at that time. The hypothesized relation between diet and lifestyle habits and incidence of disease seemed to be supported. Documenting effects of treatments seemed worthwhile. Full records for every patient started being kept in early 2009. Analysis of data collected up to the present has shown it to be a useful resource for current and future research. This is presented in more detail in section 1.3.

Figure 1.1 Growing wheat grass

Figure 1.2 *Rasāhāra* employees taking care of wheat grass

Figure 1.3 Team *Rasāhāra*

Figure 1.4 Different stages of Wheat grass

Figure 1.5 Fresh leaves Collection of *Vāsā* for treatment.

Figure 1.6 Fresh *Guḍuci* stems used for treatment.

Patients receive ***Rasāhāra*** herbal juice treatments together with instruction in Yoga practices and lifestyle including traditional rules of food intake (*āhāra niyama*) (*Yogaratnākara trans. Tripāthi I, Tripāthi D, Nityapravrittiprakāraḥ, v108-109*). Details are in Chapter 2's Review of Traditional Literature. Those following recommended foods and meal timings reduce sugar levels and weight / Body Mass Index. Diagnosis and treatment of T2DM are well established. Treatment protocols include several components: classic *Āyurveda doṣa prakriti*-based lifestyle recommendations, including timing of meals (Lad V., 2005); *Rasāhāra* herbal juices, delivered as food supplements to the patient's home; *Yoga* practices; and other therapies, including Naturopathic fasting, mud-packs etc. All these formed the basis for the study reported in this thesis: a controlled trial (CT) of Yoga and *Rasāhāra* for early detected T2DM patients not yet taking western medicine. All details are given in Chapter 4, Methods.

1.1.1 Diabetes

Diabetes is generally equated with elevated levels of glucose and glycosylated proteins in the bloodstream, and similarly high levels in the urine, caused by failure of body cells to absorb glucose from the blood, usually facilitated by the hormone insulin. Failure of cells to respond to insulin, insulin resistance, is the first stage of T2DM normally occurring in adults. It results in elevated levels of insulin in the blood stream, and may cause exhaustion of the insulin producing β cells in the Islets of Langerhans in the pancreas.

Failure in infancy results in type 1 diabetes. Both these are called insulin-dependent diabetes. Previously Type-1 diabetes was called juvenile-onset diabetes, and is usually caused by an auto-immune reaction where the body's defense system attacks the insulin-producing β cells. Reasons for this are only partly understood. Those with type 1 diabetes produce little or no insulin. The disease may affect people of any age, but usually develops in children or young

adults. Patients with it require daily insulin injections to control blood glucose levels. Those without access to insulin, die. (N Engl J Med, 2005)

Type-2 diabetes (T2DM), formerly called non-insulin dependent diabetes or adult-onset diabetes, accounts for **at least 90% of all diabetes cases**. It is characterized by insulin resistance or relative insulin deficiency, either or both of which may be present at the time of diagnosis. It may start at any age, often remaining undetected for many years, only diagnosed when a complication appears, or a routine blood or urine glucose test is done. Often, but not always, it is associated with overweight or obesity, which can itself cause insulin resistance and high blood glucose levels. T2DM patients can often manage their condition initially through exercise and diet, though with time most require oral drugs and / or insulin. (Gillies, C. L., Abrams, et. al. 2007)

1.2 DIABETES AND *PRAMEHA* ACCORDING TO *ĀYURVEDA*

Āyurveda is the world's most ancient codified system of medicine, tracing its texts back to the times of the *Vedic ṛiṣīs, Atreya, Bhāradvāja* and *Agniveṣa,* (*Caraka Saṁhitā, Su. Ch.17, v82-83*) and based on cognition of factors controlling the physiology, *Vāta, Pitta* & *Kapha Doṣas*, (*Caraka Saṁhitā, Su. Ch. 12, v12*), and how strain on the system drives them out of balance. Strain compromises regulation and leads to illness (*Caraka Saṁhitā,Su.Ch.12 v13*), eventually chronic, non-communicable diseases (NCDs) like diabetes (*Vāgbhatta A.H.Ni.CH.10, v5*).

1.2.1. Theory of *Ṣaṭkriyākāla*

Āyurveda's Suśruta Saṁhitā describes six main stages of pathogenesis known as *Ṣaṭkriyākāla* (*Suśruta Saṁhitā, Su.*Ch. 21, v36). Three stages described in *Caraka Saṁhitā* were extended to six after some 3,000 years had passed and *Ācārya Suśruta* wrote his *Suśruta Saṁhitā* just

before the time of *Buddha* in 500 BCE. The significance of *Ṣaṭkriyākāla* is that they permit recognition of the seed of disease onset, long before clinical indications manifest. Toxicity (*āma*) and *doṣa* mobility (*Prasāra*) are key components of the disease process. *Āyurveda* understands this in richer and more complex terms than modern medicine, which only recognizes detection and complication as the core stages of pathogenesis, though it does acknowledge initial failures of function due to stress.

The six stages described by *Āchārya Suṣruta* constitute physiological stages of pathogenesis. *Kriyākāla* means time of treatment, and guides the physician when, where and how to act. In the process of disease manifestation, the movement of morbid *doṣa* into the next stage depends upon the strength of the *nidāna* (causative factor). *Nidāna* may be of two types: (*Suṣruta Saṁhitā. Su.Ch.21, v28*)

Bāhya nidāna (External Causative Factors): include all causative factors affecting the body from outside e.g. microorganisms, dust, smoke or allergens, bad foods, injuries etc. *Abhyantara nidānas* (Internal or intrinsic causative factors): one or more vitiated *doṣas*. No disease manifests without *doṣas* being vitiated either by *nidānas*.

According to *Āyurveda*, pathogenesis occurs in the following sequence: Onset of *nidānas* → Vitiation of one or more *doṣas* → Spread of vitiated *doṣas* to other parts of the body → Vitiated *doṣas* invading and localizing in weak and susceptible *dhātus* or tissues → Damage to tissues → Disease manifestation → Complications → Fatality.

The first four stages are easy to treat because tissue or organ damage has not yet occurred. The last three stages of the process constitute formation of disease and complications. *Doṣa* movement depends on strength of the *nidāna*. *Kriyākāla* give us the knowledge of diagnosis, prognosis and required level of intervention to stop establishment of the disease. Competent

physicians evaluate and understand these stages before treating the patient. (*Suṣruta Saṁhitā. Su.Ch.21, v36*).

Āyurveda's six stages of *Ṣaṭkriyākāla* or disease process are described as follows-

***SANCAYA*:** the first stage of *Ṣaṭkriyākāla* means accumulation of *doṣas* due to *nidāna(s),* pathogens or *Hetu* (causative factors). But they do not leave their normal locations. (*Suśruta Saṁhitā,* Su.Ch.21, v18). Causes of *sancaya* are:

(i) *Kāla Swabhāva (Natural)*

(ii) *Trividha hetu* (Three types of causative factors)

- *prajñāparādha* (fault of the intellect),
- *Asātmendriyārtha samyoga* (Wrong use of sensory organs),
- *Vyāpanna hetu* (Inherent cause).

(iii) *Sapta Dhātus* and three *Malas* (Where the *Dūṣya* takes place) (A*ṣtānga Sangraha Sū.*Ch.1)

- *Sapta Dhātus* are *rasa, rakta, māmsa, meda, asthi, majjā, ojasa* & *Śukra*
- Three Malas are *Mūtra* Vi*ṣthā* & *Sveda*

Insufficient *nidāna* permits *doṣas* to remain in their correct locations. A desire for *Guṇas* opposite to *doṣas*' *Caya avasthās* may develop (*Aṣṭānga Sangraha Sū.Ch. 1, Doṣa avasthā*) *2007,p 91).*

PRAKOPA: When *doṣas* are in *chaya* condition, if the *nidāna* continues to persist, the *doṣa* state changes to *prakopāvasthā*. *Doṣas* aggravate in a *kopa* state, until they reach a level where they move. Occasionally, *Āchayapurvaka Prakopa* occurs, meaning overflow without prior accumulation. C*hayapurvaka Prakopa* is *kāthinyabala* (solidified increase) and

apathyaja, whereas *ācayapurvaka Prakopa* is *pathyaja* (*Caraka Saṁhitā part 2, Ni.Ch. 1, v6*), (Suśruta Saṁhitā, Sū. Ch.21, v27)

***PRASĀRA*:** the 3rd stage of *kriyākāla* occurs if *nidāna* continues. If *prakopāvasthā* is not prevented, *doṣas* move to stage of *prasāra* (Suśruta Saṁhitā, Sū. Ch.21, v32). In this stage, *doṣas* spread from their normal locations to any or all parts of the body. *Doṣas pitta* and *kapha,* the seven *dhātus* and three *malas* all need help from *vāta doṣa* to drive *prasāravasthā.*

***STHĀNASAMṢRAYA*:** Continued influence of the *nidāna* factor on *prasāravasthā doṣās* moves them into the stage of *Sthānasamṣraya* (Suśruta Saṁhitā, Sū. Ch.21, v33). Forced relocation of *doṣās* at a new site requires certain preconditions: the *nidāna* must be potent enough to cause damage. Then the vitiated *doṣā(s)* will damage the tissues (*Dhatu Duṣti*). There should be some weakness in the surface of some *ṣrota* i.e. *Kha-vaigunya* (tissue depletion or certain disturbances) (*Carak Samhitā Ni.Ch.1Comentry by Śarmā PV chapter 1, v12*). *Duṣti* in the *Kha-vaigunya* is called *Duṣya. Nidāna + prasāravasthā → Prasāra doṣās → Dhātu Duṣti* or formation of *Duṣya → Doṣās + Duṣya* in circulation → *Kha-vaigunya* (Localization) = Seed of local disease manifestation (the first, foundation stage of *vyādhi*).

***VYAKTA*:** if the *nidāna* continues in the *Sthānasamṣraya* stage, *doṣas* inevitably enter the *Vyaktibhāva* or *Vyādhi Darśana* stage, known as *Vyakti.* This represents full blown disease. The stage facilitates the physician's analysis and diagnosis, and plan for lines of treatment (Suśruta Saṁhitā, Sū. Ch. 21, v34).

***BHEDA*:** The sixth and final stage of *Ṣaṭkriyākāla* is called *Bheda*. Here the disease course may only be relieved by surgery otherwise it has attained the chronic stage, causing other disorders called *upadrava* (complications), and may finally end in fatality. (Suśruta Saṁhitā, Sū. Ch. 21, v35).

1.2.2 *Prameha*

Āyurveda recognizes three types of *prameha* (pre-diabetes) viz., *Kaphaja Prameha, Pittaja Prameha* and *Vātaja Prameha*, dysfunction of *Kapha, Pitta* and *Vāta* respectively. Of these, *Vātaja Prameha* is incurable (Carak Samhitā, Ni. Ch. 4, v3). *Pittaja Prameha* is difficult to cure compared to *Kaphaja Prameha*. In *Kaphaja* and *Pittaja Prameha*, the *Doṣa* having excess fluidity (i.e. causing *Prasāra*), *Kapha* or *Pitta* is the cause. *Dhātus* involved in *Prameha* are: *Kleda* (body fluids), including *Lasikā* (lymph), *Rasa* (blood plasma) and *Rakta* (blood cells), *Mamsa* (muscle tissue) and *Vasā* (muscle fat), *Meda* (fat tissue), *Majja* (bone marrow), and *Śukra* (semen). *Māmsa*, *Vasā*/*Meda* and *Majjā* increase in *bala*, and decrease in lubricating quality (*Shleshmā*); the remaining *Dhātus* increase in quantity only. (Carak Samhita, Ni. Ch. 4, v 5-7, 26) Mutually supporting influences of these three factors, *Hetu*, *Doṣas*, and *Dhātus*, aggravate either *Kapha* or *Pitta Doṣa*, initiating processes leading to *Prameha*'s manifestation. *Prasāra* spreads the *Doṣa*, all over the body, first aggravating *Meda Dhātu* (lipocytes in adipose tissue), and causing increase in quantity and decrease in fluidity of *Meda*.

The *Pūrva rūpa* (initial symptoms) of *Prameha* include pre-diabetic symptoms and early manifestation (vascular changes, obesity, etc.) of diabetes or subclinical diabetes. *Pūrva rūpa* indicate that disease onset has occurred. They appear prior to manifestation. At this stage, '*Doṣa-dūṣya sammurcana*', tissue aggravation begins. Symptoms in the *pūrva rūpa* stage are *avyakta* (unmanifest) or *mrutu* (sleeping). The *Brihatrayi* classics do not mention any specific *pūrva rūpa* for *Madhumeha*, but *Prameha*'s *pūrva rūpa* are discussed (*Carak Samhitā Nidāna Sthāna*, Chapter 4, v 47); (*Suśruta Samhitā, Ni.* Ch. 6, v 5) (*Aṣtānga Hridayam, Ni.* Ch. 10, v38-39).

Avoiding or reversing these conditions requires *pathya āhār* (good quality food) and modifying lifestyle, which help keep the system well-regulated without vitiating *doṣas* further into NCDs like diabetes.

Figure 1.7 Qualities of *Tridoṣas*:

 *Vāta* (Air and Space)	 *Pitta* (Fire and Water)	 *Kapha* (Water and Earth)
Light	Light	Heavy
Cold	Hot	Cold
Dry	Oily	Oily
Rough	Sharp	Slow
Subtle	Liquid	Slimy
Mobile	Sour	Dense
Clear	Pungent	Soft
Dispersing		
Erratic		
Astringent		

TABLE 1.2 LOCATION OF *TRIDOṢAS*:

5 Types of *Vāta Doṣa*	**5 Types of *Pitta*** *Doṣa*	**5 Types of *Kapha*** *Doṣa*
1. *Prāṇ Vāta* – It located in the brain, head, throat, heart and respiratory organs, Governs inhalation, perception through the senses and governs the mind. 2. *UdānaVāta* - It is present in the navel, lungs and throat. Governs speech, self expression, effort, enthusiasm, strength and vitality. 3. *SamānaVāta* - It exists in the stomach and small intestines. Governs peristaltic movement of the digestive system. 4. *ApānaVāta* - Located between the navel and the anus. Governs all downward impulses (urination, elimination, menstruation, sexual discharges etc.) 5. *Vyāna Vāta* - Centred in the heart and permeates through the whole body. Governs circulation, heart rhythm, locomotion.	1. *Pāchaka Pitta* - Located in the lower stomach and small intestine. Governs digestion of food which is broken down into nutrients and waste. 2. *Ranjaka Pitta* - It is present in the liver, gallbladder and spleen. Governs formation of red blood cells. Gives colour to blood and stools. 3. *Ālocaka Pitta* - It exists in the eyes. Governs visual perception. 4. *Sādhaka Pitta* - Located in the heart. Governs emotions such as contentment, memory, intelligence and digestion of thoughts. 5. *Bharajaka Pitta* - Located in the skin. Governs lustre and complexion, temperature and pigmentation of the skin.	1. *Kledaka Kapha* - It is present in the upper part of the stomach. Governs moistening and liquefying of the food in the initial stages of digestion. 2. *Avalambhaka Kapha* - It exists in the chest, heart and lungs. Governs lubrication of the heart and lungs. Provides strength to the back, chest and heart. 3. *Tarpaka Kapha* - Located in the head, sinuses and cerebrospinal fluid. Governs calmness, happiness and stability. Nourishment of sense and motor organs. 4. *Bodhaka Kapha* - Centred in the tongue, mouth and throat. Governs perception of taste, lubricating and moistening of food. 5. *Çleçaka Kapha* - Located in the joints. Governs lubrication of all joints.

1.2.3. *Āyurveda* Lifestyle Prescriptions

The *Svasthavritta* (*Yoga Ratnākara*, 1998, p49) section states that *svāsthya* (optimal health) is lost for one of the following reasons: poor dietary habits including overeating, under eating or eating wrong food; not following *Dinacharyā* and *Rātricharyā* (*Yoga Ratnākara*, 1998, p71); misuse of any organ; strains on the system due to seasonal changes; bad mental or physical habits; and accidents. *Āyurveda* promotes good habits to maintain or restore *svāsthya* by advising appropriate diets, and individualized levels of work and other activity appropriate for the person concerned. It recommends supplementing diet with *Swarasa* juices from fresh herbs, since these provide high levels of *Prāṇa*, are low cost, and easy to prepare.

Caraka Samhitā provides the following guidance on diet and food consumption. (*Caraka Samhitā*, Vi. Ch. 1, v24):

Nine rules of eating food:

1. Warm	4. When previous meal is digested	7. *Not eat fast*
2. Unctuous	5. Items non antagonistic in property	8. Not eat too slow
3. Proper quantity	6. Eat in favorable place in favorable accessories	

9. Not eat while talking/laughing/distracted

Additionally, order of eating food, specific indications and contraindications, palatability, and richness of qualities form the foundations for *Āyurveda's* rules of eating. One should not eat before excreting feces and urine, nor without appetite or after excessive hunger. These considerations are used to organize patterns of food intake and timing of meals.

1.3 *YOGA* AND DIABETES:

Regarding Yoga practices, these purify the mind and reenergize the subtle physiology. *Yoga* is both a science of life and a science of the soul; a tool to free oneself from physical pain and

mental agony, and a means to attain spiritual liberation. *Yoga* practitioners aim for many goals, one being physical health. *'Ṣatkarma'* is the first step, its six *kriyās* remove excess *Vāta, Pitta* and *Kapha Doṣas* from the body. *Nāḍī Śodhana* regulates the five *Prāṇas*.

1.3.1 Concept of *Panca Koṣas*: To discuss Yoga's approach to Diabetes (Nāgendra , *Nagaratnā et al*, 2003), we must consider its approach to disease in general, which depends on understanding the various *koṣas*, the coverings of the spirit or atman revealed in deep Yoga meditation. First is the physical body, which can be perceived by our senses, the '*Annamaya koṣa*'. Subtler than the physical body is the *'Prāṇamaya koṣa*, the body of vital energy or *Prāṇa*. For healthy functioning of cells in the *Annamaya koṣa*, this *koṣa* must supply *Prāṇa* in correct amounts. Health and efficiency of the physical body depends on healthy, balanced functioning of the *Prāṇamaya koṣa*. A person who masters the *Prāṇamaya koṣa* lives longer. One should learn the art of drawing minimal quantity of *Prāṇa* for function of the *Annamaya koṣa* when resting, and also expend *Prāṇa* most economically at work. In *Madhumeha*, *Prāṇa* is considered important in enabling insulin to act on cell receptors. (*Nāgendra Nagaratnā et al* 2003)

The third *koṣa* is the *Manomaya koṣa*, which may be equated with the emotions, as it contains likes and dislikes, which convert into positive and negative emotions. Negative emotions develop stress, increasing sugar levels in the blood. The fourth *koṣa*, an aspect of our thinking and intellect, is the *'Vijnānamaya koṣa'*, which contains the faculty of intellectual discrimination and decision making, *Buddhi*. It contains a concept library guiding the *Manomaya koṣa*; for a diabetic to return to health, the *Vijnyānamaya koṣa* must remind them to say 'no' to sweets. The fifth *koṣa* is the *'Ānandamaya koṣa'*, the subtlest state of personal existence; access to it brings mastery over the entire body-mind complex. *Yoga* considers diabetes a disease where such mastery is very poor. (Kalra S. Sridhar G. R. et. al, 2013).

With prevalence of diabetes hitting record highs, new methods of treatment are being sought. India is not only diabetes capital of the world, but also the land that introduced the world to Yoga's healing powers. When the two meet, results may be impressive. Simply put, diabetes is a metabolic condition occurring either when the body cannot use insulin properly, or when

the hormone is not produced in sufficient quantity. Yoga's potential to cure to diabetes, does not make it an alternative to medical treatment, but rather a complementary treatment.

Yoga practice can help manage and control diabetes. Since T2DM is often caused by deep-rooted stress due to hectic lifestyle, it can also act as a preventive measure. Including yoga in the daily regime can help reduce weight, blood sugar levels, and blood pressure. Along with proper medication, yoga can help reduce severity of diabetes, and avoid complications.

1.3.2 Concept of *Ādhi and Vyādhi*: A fully functioning *Ānandamaya koṣa* keeps a person in perfect harmony with all their faculties in balance, i.e. in perfect health, *swāsthya*. The *Vijnyānamaya koṣa* channels activity in the right direction. At the *Manomaya koṣa* level imbalances start. Here, likes and dislikes come into play. Without the *Vijnyānamaya koṣa*'s guidance, they tend to direct our actions inappropriately. Stress is largely responsible for moving us in the wrong direction. Going against the correct path causes imbalance, resulting in illness. Inappropriate mental tendencies are called *Ādhis*.

Ādhis do not manifest at physical level, but results of hidden desires slowly appear in the physical body, *Annamaya koṣa*. Ignorance of one's deep state of bliss leads to wrong actions like eating unwholesome food, doing things at wrong times, and living in unhealthy dwellings. All these breed *Vyādhis*, physical diseases.

Ādhis are twofold, *Sāmānya* and *Sāra. Sāmānya* causes physical diseases including psychosomatic ailments; *Sāra* brings rebirth. Suitable techniques and a congenial atmosphere

can cure *Sāmānya* rooted diseases. Such problems resolve by living from the *Vijnyānamaya koṣa*. Another category of ailments are *Anādhija Vyādhi*, which do not originate in the mind. They include contagious and other infectious diseases. Yoga texts say that *anādhija Vyādhis* can be handled through *Dravyas* (herbal medicines) as well as *Mantras,* with their vibrational characteristics. Correctly used, *Mantras* bring purity of mind, allowing *Prāṇa* to flow freely in the body. Digested food is better assimilated and diseases vanish. (Nāgendra H.R., Nagaratnā R, 2013).

1.3.3 Concept of stress: When people cannot deal with demands from their environment, they become stressed. Stress conditions have two components, physical and psychological. Physical stress directly affects the body. Psychological distress depends on how a person reacts to their life circumstances, and affects the mind. People today tend to think faster than 50 years ago. Mental activity in is so much and so fast that they can no longer cope. It also makes them emotionally hypersensitive. This upset them to an extent that leads to disasters. Increasing youth crime presents an example of over-sensitised, excitable states of mind.

When a person is subjected to stress, the entire physiology tries to adapt by making required internal adjustments. For example, when people have to fight, muscle tone increases to contract in powerful co-ordinated ways; increased muscle activity demands increased energy expenditure, supplied by increased amounts of glucose brought by dilating blood vessels. Blood glucose level rises to meet demand. Increased metabolism requires more oxygen; breath rate increases to supply the extra demand. Bronchial passages dilate increasing air flow. To supply more blood to the brain, its blood vessels dilate. Glucose consumption generates more heat, which must be removed to stop the system overheating. Quantities of blood rush to sweat glands, which exclude sweat. Evaporation takes heat out of the body. To increase blood flow to various organs, pulse rate increases; so does blood pressure. As digestive functions are not immediately needed, intestinal blood vessels constrict reducing

digestive secretions, though stomach acid secretion increases. All such changes should return to normal after the danger passes, and the person is back in a safe environment.

The whole procedure is carried out by two major systems, the autonomic nervous system (ANS) and endocrine system. The ANS has two parts, the sympathetic and parasympathetic nervous systems. The first stimulates organs according to the need of the time, while the parasympathetic nervous system pacifies them after the situation has passed. Constantly elevated blood sugar levels can result from repeated upsurges over years due to constant sympathetic stimulation. Major stress may even activate hereditary tendencies for the disease.

Endocrine glands involved in stress adaption are the adrenals and pituitary. The thyroid gland may also be involved. These glands secrete highly potent hormones in small quantity. The mid part of the adrenal gland, the adrenal medulla, secretes adrenalin and nor-adrenalin while its outer layer, the adrenal cortex secretes cortisol, stress hormone. The pituitary's Adreno CorticoTrophic Hormone (ACTH) controls cortisol, while its thyroid stimulating hormone (TSH) controls the thyroid hormones, T4 (thyroxine) and T3 (tri-iodotyrosine). Secretion of both ACTH and TSH are controlled by hypothalamus hormones, CRH and TRH. Growth hormone secreted by the pituitary also assists in adaptation to stress. Being responsible for physiological changes during stress, all are considered stress hormones. The average human being can tolerate a certain amount of mental trauma without too much disturbance, unless frequency increases, so that brain activity increases in emotional centres close to the hypothalamus and pituitary. EEG studies confirm these changes; biochemical studies observe increased acetylcholine in the blood and decreased acetylcholine in the brain. Such changes increase irritability (Nāgendra H.R., Nagarathna R. 1986).

Another important dimension of stress is the relationship between the environment and a person. How do they react to stressful situations? Reactions can be managed by yoga. In his Yoga *Sūtras*, *Mahariṣi Patañjali* uses the term *Kleśa* to describe stress. (Yoga Sutras II.3)

Being tossed up and down by emotional stressors expends large amounts of energy, impairing efficiency, and deteriorating quality of life. The whole process, its origin, development, aggravation and repurcussions are described in two *ślokas* of *Bhagavad Gītā* (Gītā, II.62, 63). Their dramatic description matches *Patañjali's* concept of *Kleśa*. Continuous emotional outbursts like anger cause loss of discrimination, reducing actions to the level of instinct. *Patañjali* describes such states as *abhiniveśā* (helplessness), gross manifestations of stress; he proposes Yoga for 'thinning' *Kleśas* (YS, II.2). *Yoga* stress management brings balance to all *Koṣas*, and is holistic. It reverses challenges of stress stated in *Bhagavad Gītā* (Gita V.23), using three principles of Yoga. 1. Relax the Body; 2.Slow the Breath; 3. Calm the Mind.

Stress makes a person either hyper- or hypo-active. Both tendencies are found in each mind, but may occur in different proportions. A remedy for one person may not be right for another. An example: *Śavāsana*, relaxation posture, can be the solution for the hyperactive, but will increase *Tamoguna* (inertia) in a lazy person. Stimulation of desires may be good for lazy people, but is a causative factor for stress in *Rajasika* (hyperactive) persons.

The problem's solution is stated in a commentary on *Māṇḍukyopaniṣad*, the shortest most profound. It describes a 2-fold *Sādhanā* process of rest and activity (*Māṇḍukya Kārikā 3-44*). Successive stimulation and relaxation solves complex problems of mind. SVYASA designed such a kind of Yoga program containing *Ā*sanas and *Prāṇāyāmas* for stimulation, and three relaxation techniques in *Śavāsana* (IRT, QRT & DRT) described below.

1.3.4 The Importance of Yoga Breathing Practices

The respiratory system, both voluntary and involuntary, acts as a bridge between body and mind. Voluntary control can change involuntary function. Objectives of *Yoga* breathing are many: bringing into action all lobes of lungs; normalizing breath rate; rhythmic breathing. Practices include sectional breathing, full Yogic breathing, and *Kriyas* (cleansing practices). (Nāgendra , Nagaratnā. 2013, P 41).

1.4 A NEW APPROACH

Our approach integrates *P.Y. Vaidya's* approach to *Āyurveda*, his *Rasāhāra* herbal juice program, with SVYASA's *Yoga* Medicine. Though seemingly physical, Yoga practices treat mental and emotional aspects on several levels. First, they resolve stress causing insulin resistance; then they treat habits of mind inimical to health, attitudes producing negative emotions, hurting both patients and those around them. To achieve this, patients learn to increase *Vijnynāmaya koṣa* function, and discriminate what is good for them from the bad.

Rasāhāra advises selecting *sātvika* food. Increasing its proportions in patient's diet improves health, sense of well-being, and positive outlook. Health parameters improve, sugar levels reduce. *Rasāhāra* programs complement *Yoga* practice by helping patients release deep rooted stress. Initial clinical data revealed that most diabetes patients had associated problems e.g. constipation or other digestive disorders, and were already on medication. Such problems are helped by the 3-in-1 approach to health restoration: *Rasahara, Yoga* and *Ahāra-Vihāra*. Biomedicine only aims to reduce blood sugar levels; even then, only temporarily. It reduces neither stress, nor wrong food habits, nor sedentary life style, all *Hetus* driving the aetiology. Pathogenesis inevitably continues. Eventually, the patient succumbs. In contrast, our *Rasāhāra Kendra* clinic results suggest that integrating the three treatment modalities helps patients become self-sufficient in their struggle against both T2DM and its complications.

1.5 SELECTION OF FOOD FOR BREAKFAST

According to *Yoga* and *Āyurveda* texts and some modern meal time studies, one should only eat cooked food twice a day *(Yoga Ratnākara, p54, v108-109,1998).* Raw food is full of vitamins and minerals, easily digested, and fulfils all bodily needs. It is safe to eat even with elevated sugar levels. Easily digested foods should be selected; they reduce pressure on the digestive system and save energy. This study is based on replacing breakfast with herbal juices to improve levels of *Prāṇa*, while minimizing its expenditure on digestion. *Swarasa* (Yoga Ratnākara Prameha p93, v1, 1998), fresh herbal juices are best forms of herb to take. Many *Āyurveda* texts attribute therapeutic importance of their subtle energy. To understand their physiological effects, we considered *Guṇas* of herbs and other food supplements; and also ensured that appropriate quantities of nutrients were consumed.

Their many health benefits make raw foods like fresh fruits and vegetables, herbs, dried and sun-dried herbs, grains, and raw nuts important dietary components; they contain more *Prāṇa* (vital energy) and minerals than cooked foods. When added to a regular diet, they bring more essential nutrients and vitamins than cooked foods, and they do not deposit or develop *Āma.* In short, they are extremely health giving. Sprouted grains can form an especially important part of breakfast; their beneficial effects particularly merit further study.

1.5.1. Introduction of *Rasāhāra:* As a Breakfast Modification for Pre-diabetes

Biomedical physicians do not prescribe medicine for pre-diabetes. In contrast, as a *Prakopa* state *Āyurveda*, advises treatment. This study shows that *Prakopa* can be cured by life-style modifications, including *Rasāhāra* as modified breakfast. *Prakopa*, 'Aggravation', is the second stage of *ṣaṭkriyākāl*. No clinical symptoms known to allopathic medicine manifest during *Prakopa*, but *Vaidyas* physicians recognize its significance, and reverse it by advising

dietary and behavioral changes. *Āma* identified as an aggravated state by pulse diagnosis is an example. *Rasāhāra* as modified breakfast can reduce *Āma* and reverse its *prakopa* state.

1.5.2. Why '*Swarasa*'- Freshly Prepared Herbal Juices

According to *Yoga Ratnākara*, a herb's best medicinal properties are obtained from its freshly prepared juice, known as ***Swarasa*** in *Āyurveda.* The full quotation is given in Chapter 2. The 5 herbal juice clinics use the term *Rasāhāra* to popularize, them and their importance.

1.5.3. The Four herbs used in this study

Āyurveda lists 20 types of *prameha* in 4 clusters, or major types. *Kapha* type (with 10 subtypes), *Pitta* type (with 6 subtypes), *Vāta* type (with 4 subtypes) and Juvenile diabetes (Type 1) in children. *Madhumeha* is one of these 20; a subtype of *Vātaja prameha*, similarities in signs and symptoms of which correlate it with T2DM.

Medical drugs for Diabetes include insulin and hypoglycaemic agents such as sulfonylurease (Metformin), which have serious side effects. The search for safer hypoglycaemic agents is an important research area. *Āyurveda*'s *Bhāvprakāśa Nighanṭū* lists 41 plants as *mehaghna* / *pramehaghna*. Most possess *kaṭu, tikta*, and *kaṣāya rasa*, *Ūṣnavīrya, kaṭu vipākalaghu, rukṣa guna,* and exhibit *Kaphaghna*, or *Kapha-pittaghna* properties, balancing Kapha or Kapha-Pitta. All have been shown to be anti-diabetic, mostly in animal models: anti-hyperglycaemic, insulin secretors, nephro-protective, alpha amylase and glucoside inhibitory, anti-oxidant and anti-hyperlipidemic, all are helpful for diabetes risk factors; some prevent albuminurea.

Caraka states that etiological factors of *Prameha* have qualities like *Snigdha*, *Śīta*, *Gurū*, *Picchila*, *Madhura* and *Ślaksna*. All cause deposition of excess, unwanted matter in the body i.e. excess vitiated *kapha, pitta* or vata and *dhātu dūśyas* of seven *dhātus* leading to excess mala formation. *Kaṭu rasa* has *laghu* and *rukśa gunas*; it absorbs *dravapadārtha*, *kleda, kapha mūtra* present in the body due to *Śoṣan* properties. *Kaṭu rasa* is *Śoṣan* (absorbent) of

sveda and *māmsachedan*. *Tikta rasa* has *kleda, meda, majjā, sveda, mūtra* and *kaphaśoṣan* properties. *Ūṣnavirya* is the opposite of *śīta guṇa* of *kapha* and *kleda*. *Kaṭu vipāka* also helps to destroy *kleda* and *kapha*. *Laghu* and *rukśa guṇas* reverse *kapha* etiological factors, *śīta* and *gurūguṇa*. *Dravyas* listed in Table can be used for cases of *Kaphaja prameha*. (Poonam et al, 2015).

TABLE 1.3: PHYTOCHEMICALS IN FOUR HERBS:

Phytochemicals	**Triticum aestivum**	**Adhatoda vasica**	***Tinospora cordifolia***	***Emblica officinalis Gaertn***
Alkaloids	Present	Present	Present	Present
Flavonoids	Present	Present	Present	Present
Glycosides	Present	Present	Present	Present
Saponins	Present	Present	Present	Present
Tannins	Present	Absent	Present	Present
Phytosterols	Present	Present	Present	Present
Triterpenoid	Present	Present	Absent	Present
Amino acids	Present	Present	Present	Absent
Protein	Present	Absent	Present	Absent

Table 1.4: NAMES OF FOUR HERBS IN DIFFERENT LANGUAGES:

Language	**Triticum aestivum**	***Adhatoda vasicaNees***	***Tinospora cordifolia***	***Emblica officinalis Gaertn***
Sanskrit	*Godhūma truṇa*	*Vāsaka*	*Amrutavalli, Amrutā, Madhuparni, Guḍucikā, Chinnobhāva*	*Āmalaka, Āmrutaphala, Dhātriphala*
Assamese	-	*Titabahak, Bāhak, Vāchaka*	*Siddhilatā, Amarlatā*	*Āmlaku, Āmlakhi, Āmlakhu*
Bengali	*Wheatgrass*	*Bāksa, Vāsaka*	*Gulanca*	*Āmla, Dhatri*
English	*Wheatgrass*	*Vāsaka*		*Emblic Myrobalan*
Gujrati	*Ghaunū Vadhārū*	*Aduso, Ardusi, Adulso*	*Galac, Garo*	*Āmbala, Āmala*
Hindi	*Gehun ke Jawāre*	*Adusā, Arusā*	*Giloe, Gurca*	*Āmla, Aonla*
Kannada	*Vītagrās*	*Adsale, Adusoge, Atārushā, Adsole, Adāsāle*	*Amrutaballi*	*Nellikayi*
Kashmiri	-	*Vāsā*	*Amritā, Gilo*	*Embali, Āmli*
Malayalam	*Gēātampgrass*	*Attalataka m, Atālotakam*	*Chittamrutu*	*Nellikka*
Marathi	*Gahu truṇa*	*Vāsā, Adulsā*	*Gulvel*	*Āvalkāthi*
Oriya	*Wheatgrass*	*Basanga*	*Guluchi*	*Ānala, Ainla*
Panjabi	*Kaṇaka*	*Bhekar, Vansa, Arusā*	*Gilo*	*Aula, Āmlā*
Telugu	*Godhūma Gaddi*	*Vasambu, Adāthodai*	*Seendal, Seendil kodi*	*Nellikkai, Nelli*
Urdu	*Wheatgrass*	*Addasaramu*	*Thippateega*	*Usirikā*

TABLE 1.5 PHARMACOLOGICAL IMPORTANCE OF HERBS:

S. No.	Name	Family	Total Phinolic contains	Characteristics
1	Adhatoda vasica	Acanthaceae	92.4±0.14 mg/g	Antioxidant, Free radical scavenging activity, antispasmodic, fever reducer, anti-inflammatory, anti bleeding, bronchodilator, anti-diabetic, Anti-hyperglycaemic, disinfectant, anti-jaundice, anti-stress, oxytocic and expectorant
2	***Tinospora cordifolia***	Menispermaceae	17.50 ± 0.11 mg/g	Antioxidant, Free radical scavenging activity, anti-helminthic, anti-arthritic, anti-periodic, anti-pyretic, blood purifier, cardiac, carminative, digestive, diuretic an expectorant, stomachic, rejuvenating, anti-aging, antitumor, appetizing and anti-inflammatory, Anti-hyperglycaemic, anti-allergic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, immunomodulatory and anti-neoplastic activities
3	**Triticum aestivum**	Poaceae	1.0 ± 0.1 mg/g	Antioxidant, Free radical scavenging activity, Anti-hyperglycemic, anti-carcinogenic, anti-inflammatory, Anti-asthmatic, Anti-allergic, hypolipidemic, anti-ulcer activity, anti-arthritic activity, and blood building activity in Thalassemia, immunomodulatory, laxative, astringent, diuretic, antibacterial and anti-aging, antibacterial, anti-microbial, beneficial for acidity, colitis, kidney malfunctions, atherosclerosis and swelling.
4	***Emblica officinalis Gaertn***	*phyllanthaceae*	12.4 ± 0.6 mg/g	Antioxidant, Free radical scavenging activity, Anti-hyperglycemic, anti-inflammatory and antipyretic, anticholinesterase, Antitumour, Antiulcerogenic, antipyretic, analgesic, Antimicrobial, Antifungal, Antitussive, immunomodulatory, cytoprotective, gastroprotective, memory-enhancing, ophthalmic disorders and lowering, cholesterol level, neutralizing snake venom, antimicrobial.

Table 1.6 Descriptions of four herbs:

DESCRIPTION	EO (*Ämalki* or *Āmla*)	TC (*Guḍuci*)	AVN (*Vāsā)*	TA (Wheatgrass)
IDENTITY, PURITY AND STRENGTH	Foreign matter- Not more than 2 per cent, Total Ash- Not more than 7 per cent, Acid-insoluble ash- Not more than 2 per cent, Alcohol-soluble extractive- Not less than 40 per cent, (On dried basis) Water-soluble extractive Not less than 50 per cent, Moisture content Not less than 80 per cent.	Foreign matter- Not more than 2 per cent, Total ash- Not more than 16 per cent, Acid-insoluble ash- Not more than 3 per cent, Alcohol-soluble extractive Not less than 3 per cent, Water-soluble extractive Not less than 11 per cent, For fresh drug Foreign matter Nil, Moisture content 75 per cent.	Foreign matter- Not more than 2 per cent, Total Ash- Not more than 21 per cent, Acid-insoluble ash Not more than 1 per cent, Alcohol-soluble extractive- Not less than 3 per cent, Water-soluble extractive Not less than 22 per cent.	Acid-insoluble, Foreign matter Nil.
CONSTITUENTS	Ascorbic acid and tannins	Terpenoids and alkaloids	Alkaloids and essential oil.	Phytic acid, Panta, tatra and try Phosphet
PROPERTIES AND ACTION	*Rasa : Madhura, āmla, Katu, Tikta, Kašāya Guna : Laghu, Rukña Virya : çéta Vipāka : Madhura Karma : Tridoçajit, Vruçya, Rasāyana, Cakšuçya.*	*Rasa : Tikta, Kašāya Guna : Laghu Virya : Uçna Vipāka : Madhura Karma : Balya, Dépana, Rasāyana, Sangrāhi, Tridoçnaçāmaka, Raktaçodhaka, Jvaraghna.*	*Rasa : Tikta, Kašāya Guna : Laghu Virya : çéta Vipāka : Katu Karma : Hridya., Kaphapittahara, Raktasangrāhika, Kāsaghna.*	*Rasa : Madhura, Kašāya Guna : Laghu Virya : çéta Vipāka : Madhura Karma : Hridya., Balya, Dépana, Rasāyana, Cakšuçya, Raktaçodhaka.*
IMPORTANT FORMULATIONS	*Cyavanaprāça*	*Amrutārišta, Amrutottara Kvātha Chürna, Guduchi Taila, Guduchyādi Churna, Guduchi Sattva, Chinnobhavādi Kvātha Chürṇa*	*Vāsakāsava, Vāsavāleha*	*Wheat grass juice, Powder.*
THERAPEUTIC USES	*Raktapitta; Āmlapitta; Prameha; Dāha*	*Jvara, Kuštha, Pāndu, Prameha, Vātarakta, Kāmlā*	*çvāsa, Kāmalā, Kāsa, kšaya, Kuštha, Prameha, Raktapitta*	-
DOSE	10-20 g of the drug, 5-10 ml of fresh juice.	3-6 g of the drug in powder form. 20-30 g of the drug for decoction.	10-20 ml of the juice of fresh leaves. 10-20 g of the dried drug for decoction.	100 ml juice of 50-60 gram fresh wheat grass blended in water.
Ph	5.5	7.0	10.0	7.0

1.5.3.1 ***Āmlāki*** (*Emblica officinalis*) : Also known as Indian gooseberry, *Āmlā* is an edible fruit from a tree of the phyllanthaceae family. When greenish the fruit is tender. It ages to light yellow or pinkish colour, with a few dark specks when fully mature. Its sour and astringent tastes are followed by a delicate, sweet taste. The fruit, eaten raw, cooked or pickled, is used to treat many disease conditions including hyperlipidemia and diabetes. The *Rasāhāra* clinics use it to treat many ailments including hyperglycemia, and to restore health to optimum levels.

Figure 1.8*Āmlāki* (*Emblica officinalis*)

1.5.3.2 *Guḍuci* (*Tinospora cordifolia*) : When young, *Guduci* is greenish, changing to light yellow or pinkish with a few dark specks, when mature. Like amla, its taste is sour and astringent followed by a delicate, sweet taste. Fresh stem is the most important part for therapeutic use. It is available dried in Grocer's shops and markets. The five clinics prepare its juice fresh daily according to *P.Y. Vaidya's* instructions. They have used it for 11 years.

Figure1.9 *Guḍuci* (*Tinospora cordifolia*)

1.5.3.3 ***Vāsā*** (*Adhatoda Vasica Nees*): A popular Indian medicinal plant, long in common use in *Āyurveda*. Its most useful part is the leaf: 10-30 cm long and 3-10 cm broad with a tapering base.

Figure 1.10*Vāsā*(*AdhatodaVasica Nees*)

The dried leaves are dull brown,

or light greyish brown. It has strong odour and a bitter taste. All the *Rasāhāra* clinics grow it. Its *pitta* reducing quality made it important in the jail study for 3 reasons. (1) The study started in early May, the hot season, a time of *pitta* aggravation; (2) Prisoners have short tempers caused by aggravated *pitta*, so balancing *pitta* is necessary, (3) *Vāsā* has anti-depressive effects, and thus an important role in prison populations. Prescribing *Vāsā* was therefore natural.

1.5.3.4 Wheatgrass (*Triticum aestivum Linn.*)

The common wheat plant, normally used for its grain, i.e. Shooka Varga, belongs to the Poeaceae (*Graminae*) family. Young, 7-day old plants, i.e. *Śākvarga* according to *Āyurveda,* were given in juice form after blending. An alternative is to prepare the juice from dried powder, which is also available. Both provide chlorophyll, amino acids, minerals, vitamins, and enzymes. As the best source of chlorophyll, it is a 'living food', also known as 'green blood'. Since prehistoric times, chlorophyll-rich greens of various kinds have been used as blood builders. Wheatgrass contains about 70% chlorophyll. It is said to improve blood flow.

Figure 1.11 Wheatgrass (*Triticum aestivum Linn.*)

It helps digestion and detoxification of the body. Growing it requires a specific procedure: first, wheat grains are soaked in water for 12 hours; then strained and put in a cloth to sprout for 24 hours; last, they are sown in a pot. Shoots become usable when 8 cm long. The *Rasāhāra* clinics have used the 7-day cycle procedure for 11 years. Wheatgrass keeps health optimal and prevents various disease including cancer, dengue fever etc.

TABLE 1.7 *PRAMEHAGHNA* COMBINATIONS LISTED IN *CARAKA SAMHITĀ*

Herbal combinations for Kaphaja Prameha	**Herbal combinations for Pittaja Prameha**	**Herbal combinations for all Prameha**
1. Harra, Kāyaphala, Nāgarmothā, Pathānīlodh *2. Pātha, Vāyaviranga, Arjuna, Dhanvana* *3. Haridrā, Dāruhaldī, Tagar, Vāyaviranga* *4. Kadamba, Sāla, Arjuna, Ajvāin* *5. Dāruhaldī, Vāyaviranga, Khaira, Dhava* *6. Devadāru, Kutha, Agara, Red Candana* *7. Dāruhaldī, Arni, Āmalki, Harra, Bahedā, Pāthā* *8. Pāthā, Mūrvā, Gokhrū* *9. Ajvāin, Khas, Harra, Guḍucī* *10. Cābha, Harra, Citraka, Chhitvana.*	*1. Khas, Lodhra, Anjana, Red Candana* *2. Khas, Nāgarmotha, Āmalkī, Harra* *3. Parvara, Nimba, Āmalkī, Guḍuci.* *4. Nāgarmotha, Harra, Padyakātha, Kutaj.* *5. Pathānilodh, Sugandhabālā, Yellow Chandana, Dhāya flowers.* *6. Nim, Arjuna, Āmdā, Haridrā, Blue Lotus.* *7. Śirīsa, Sarja, Arjuna, Nāgakesara.* *8. Phul Priyangu, Red Lotus, Blue Lotus, Palāsa flowers.* *9. Pipala, Patha, Vijayasāra, Veta.* *10. Dāruhaldī, Blue Lotus*	*1.Daruhaldi, devdaru, Āmalkī, Behda, Haridra* *2. Haridra Āmalkī with Honey*

1.5.4. Mechanisms of Action of Anti-diabetic Herbs

The following mechanisms are responsible for medicinal plants' anti-diabetic activity (Poonam et al. 2015): (a) α–amylase inhibition; (b) β–galactocidase and α–glucocidase inhibition; (c) Inhibition of renal glucose re-absorption; (d) Stimulation of insulin secretion from pancreatic β cells; (e) Regenerating and/or repairing pancreatic β cells; (f) Increasing

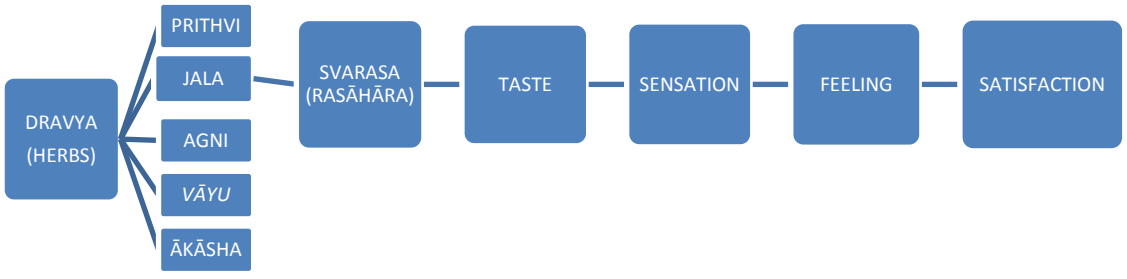
the size and number of cells in the islets of Langerhans; (g) Inhibition of insulin degradative processes; (h) Insulin resistance reduction; and (i) Improvement in digestion along with reduction in blood sugar and urea.

Carak Samhita discusses possible modes of action of *pramehaghna dravyas* (*prameha* reversing herbs). (see Table 1.2) Chief points are if the *prameha* is principally *Kapha Prakopa*, then *Kaphaghna* herbs are prescribed (see Table 1.2, left column); if the *prameha* is principally *Pitta Prakopa*, then *Pittaghna* herbs are prescribed (see Table 1.2, middle column). Common herbs are listed in Table 1.2, right column.

1.5.5. The Mechanism of *Rasāhāra* according to *Āyurveda:*

In *Āyurveda*, creation is divided into two parts, *Sajīva* & *Nirjīva*. Herbs are *Sajīva* with a common property, *Jīvani Tattva*, life enhancing. Formation of *rasa* comes from a combination of sugar, salt, carbon, hydrogen, oxygen, resin, hydro carbide & small amounts of protein & fat.

FIGURE 1.13 PROCESS OF UNDERSTANDING *RASĀHĀRA* FEELING:



Every living being has vital energy, *praṇa*. The immune system shares this characteristic. The body become disease free through *praṇa* and the immune system. Metabolism supports these. The body becomes diseased *(Rogi*), if it decreases. Herbs generate energy through sun light, a *Vāyu Janita* tendency. The earth provides them water and nutrition. They receive input from *grahas* other than the sun: *Soma* (the moon) brings *Śīta Pradhāna Anśa* (cooling properties). *Śīta Pradhāna Anśa* brings *Śīta Virya Guṇa*, strengthening the heart and benefitting cardiac muscles. *Śīta Virya Guṇa* keeps the *Chitta* calm bringing mental peace, strengthening and protecting the heart, so enhancing its function. *Āchārya Atreya* divided herbs into 6 types by taste (*Śata Rasa*) : *Madhura, Amla, Lavana, Kaṭu, Tikta, & Kaṣāya*, all easily tested by the tongue. *Tikta* & *Kaṣāya rasas* have medicinal values able to reduce *Kapha-Pitta* aggravation. (*Dvivedi V, Bhāva Prakāśa Nighanṭu*,1977, V1, p13)

1.6 Importance of Sprouted or Germinated Food following *Rasāhāra*:

Herbal juices do not contain enough protein or carbohydrate to fulfil bodily requirements of hard working prisoners (*Srilakṣmi* B, 2014, p 24). Germinated food fills the gap, is uncooked, low cost, easy to prepare and tasty.

1.6.1 Nutritional Advantages of Germinated Food

1. Vitamin C is synthesised during germination, at concentrations of 7-20 mg per 100 gm.
2. Riboflavin, niacin, choline and biotin are produced.
3. Starch is converted into sugars.
4. Anti-nutritional and toxic factors reduce in sprouts.
5. Dormant enzymes are activated improving digestibility and nutrient availability.
6. Minerals like calcium, zinc and iron are released from bound forms.
7. Sprouts can be eaten raw, as germination improves taste and texture.

1.7 IMPORTANCE OF THE STUDY FOR PRISONERS

Prisoners are isolated from family members and social activities. They ignore their general health and cleanliness. They suffer higher rates of infectious diseases, like HIV / AIDS and hepatitis; and NCDs like diabetes, especially among older prisoners. To say that prisons have become mental asylums is little exaggeration. (Rold, W. J., 2008) In general, persons convicted of committing offences are jailed regardless of their mental condition. Inmates are recognized to have exceptional mental health needs (Gunn, J., Maden, A., et. al, 1991). Studies show that prisoners have high levels of mental illness, and drug or alcohol dependence. Prison environments are very stressful, often causing prisoners mental disorders, but their psychiatric problems may go undetected and untreated. Studies report a high prevalence of psychiatric illness among male and female prisoners (Fazel S., Bains P., et.al, 2006).

Figure 1.13 Central Jail Bhopal