University of Latvia

Faculty of Medicine

Medical Doctor Degree Program

Diploma Thesis

AYURVEDIC APPROACH TO INDIVIDUALISED THERAPY OF DIABETES MELLITUS

Author: Rowan Barton

Student Number: rb09269

Supervisor: Prof. Valdis Pīrāgs M.D., PhD

Riga, 2015

TABLE OF CONTENTS

ABSTRACT 5
KOPSAVILKUMS 7
1. INTRODUCTION 9
2. HYPOTHESIS 13
3. AIM.....13
4. LITERATURE REVIEW……..13
4.1. AYURVEDA AS A HOLISTIC SYSTEM MEDICINE……...13
4.2. MEDICAL PRACTICES IN MYTHOLOGY……...13
4.2.1. The ancient writings of the *Ramayana*..……15
4.2.2. The ancient writings of the *Mahabharata*..……15
4.3. THE FUNDAMENTAL PRINCIPALS OF AYURVEDA……...10
4.3.1. Physiology in Ayurveda (*Sareera Kruya Vijnanam*)……..16
4.3.1.1. Composition of the body……..17
4.3.1.2. *Tridosha* concept.....17
4.3.1.3. *Vata dosha*.....18
4.3.1.4. *Pitta dosha*.....20
4.3.1.5. *Kapha dosha*.....21
4.3.1.6. Ayurveda Body Type (*Prakriti)* and Disease Manifestation *(Vikriti)*..24
4.3.1.7. The Five Elements (*Panchabhuta)* 28
4.3.1.8. Seven fundamental elements that support basic body structure and functioning……..29
4.3.1.9. Waste products of the body (*Malas)*……..31
4.3.1.10. Vigor (*Ojas)*.....32
4.3.1.11. Bodily Channels (*Srotas*)……32
4.3.2. The fundamental principles of pharmacotherapeuics in Ayurveda (*Dravyaguna Vijnana*)……32
4.3.2.1. Substance (*Dravya*)……..33
4.3.2.2. Taste (*Rasa*)……..34
4.3.2.3. Property (*Guna*)……34
4.3.2.4 Potency (*Virya)*……35
4.3.2.5 Drug Metabolism (*Vipaka)*……35
4.3.2.6. Specific Action (*Prabhava)*……..36
4.3.2.7 Pharmalogical Action (*Karma).*……36

4.3.2.8. Ayurvedic Drug Characteristics……37
4.3.2.9. Incompatibility (*Virudha) between medications*……37
4.3.2.10. Dosage of medications……38
4.4.2.11. Preparation of Medicines *(Bhaishajya Kalpana)*……38

4.4 DISEASE AND HEALTH……..40
4.4.1. Etiology, pathogenesis and diagnostic tools from Ayurvedic perspective ……...40
4.4.2. Diagnosis of the disease *(Roga Pareeksha)* ……41
4.4.3. Principles of Treatment *(Chikitsa*)……46
4.5. CORRELATION BETWEEN PRAMEHA IN AYURVEDA AND DIABETES MELLITUS…..……47
4.5.1. Diabetes (*Prameha)* ……48
4.5.2. Etiological classification of Prameha (*Hetu Bhedas*)……..49
4.5.3. Doshic Classification *(Vikara Bheda)*……49
4.5.3.1. Prediabetes equivalent to the *Kapha* stage of *Madhumeha*……..49
4.5.3.2. Overt Diabetes Mellitus equivalent to the *Pitta* stage of *Madhumeha*……51
4.5.3.3. Diabetes complications equivalent to the *Vata* stage of *prameha*……52
4.5.3.4. Psychophysiological constitution (*Prakriti*) and *Prameha*……53
4.5.4. Prognosis of Diabetes in Ayurveda *(Sadhya-Asadhyata)*..……..53
4.5.5. Prediabetes and Subclinical Symptoms *(Purvaroopa)* ……...53
4.5.6. Obesity in Ayurvedic texts and it's relation to *Prameha (Sthaulya)*……55
4.5.7. Complications (*Upadravas*) ……...55
4.5.8. Main aspects of pathogenesis and complications in particular of *madhumeha* according to Ayurvedic classics ……...57
4.5.9. Treatments *(Chikitsa)*……55
4.5.9.1. Dietary management……59
4.5.9.2. Lifestyle ……...61
4.5.9.3. Yoga practices……..61
4.5.10. Ayurvedic medicines for *Madhumeha*……64
4.6 INSITES OF THE LITERATURE REVIEW……68

5 MATERIALS AND METHODS……...69
6 RESULTS……...73
7 DISCUSSION……82
8 CONCLUSION……..87

9 APPENDIX……88
10 ACKNOWLEDGEMENTS……..89
11 BIBLIOGRAPHY……95
11 ETHICS COMMITTEE EVALUATION……..102

ABSTRACT

AYURVEDIC APPROACH TO INDIVIDUALISED THERAPY OF DIABETES MELLITUS

Background:

The total number of people with diabetes was projected by the WHO to rise from 171 million in 2000 to 366 million by 2030. Ayurvedic medicine is one of the world's oldest medical systems and has millennia of diagnosing and treating diabetes mellitus. It is important to identify if there is potential in combining conventional treatments and Ayurvedic treatments for Diabetes Mellitus to decrease the worldwide burden of the disease.

Objectives:

The aim of this study was to evaluate *dosha* based *Prakriti* and *Vikriti* differences in the target patient base. To identify common Ayurvedic diabetic medications currently used and their known medicinal effect from literature. To identify Ayurvedic consultation patterns over the 3month research period. To identify if during Ayurvedic consultations changes to treatment regime occurred and to identify statistical differences in three month baseline values of FBG, Hba_{1c} and BMI.

Materials and Methods:

After defined inclusion and exclusion criteria were met a randomised two armed placebo control prospective cohort study of 32 subjects in total, 21 subjects in 1^{st} arm and 11 in 2^{nd} arm was conducted. The 1^{st} arm patients used Ayurveda medication in combination with conventional treatment and the 2^{nd} arm patients used placebo medication in combination with conventional treatment. Results were tabulated into SPSS version 11.5 and statistical analysis was performed.

Results:

As the patient data was received it became evident that there are too many sub groups for both *Vikriti* and *Prakriti*. One-way ANOVA test was performed to determine whether there is statistical significance between baseline values of *Prakriti* subgroups but there were no statistical significance due to the current small sample size. Mean Fasting Glucose of control group was 157mg/dL, mean Hba1c was 8% and mean Body Mass Index was $27kg/m^2$. There

is a strong relationship of *Pitta* and *Kapha* medications in the study population. 23 of 32 patients had changes to their medication regime over the three month period equivalent to 74% and 14 patients had no change to their medicinal regime. Paired Differences of Base FBG – 3M FBG for True Group was statistically significant at 0.028 while placebo group was 0.821. Paired Differences of Base Hba_{1c} – 3M Hba_{1c} for True Group was 0.664 and placebo group 0.632. Paired Differences of Base BMI – 3M BMI for True group was 0.233 and Placebo group 0.558.

Conclusions:

More precise inclusion criteria is needed allowing for stratified random sampling be done for each *Prakriti* and *Vikriti* subgroup. This will allow each subgroup to have sufficient patient numbers before proceeding to be statistically analysed. The relationship between BMI/obesity and diabetes mellitus type two was justified. Current inclusion criteria reflects a bias towards *Pittaja* and *Kaphaja* stages of diabetes thus we see that in the medications used there is a bias towards *Pitta* and *Kapha* medications. There is continuity in relationship between the Ayurvedic Physician and the patient due to the regular consultations for the purpose of comprehensive patient management. It was statistically proven that Fasting Blood Glucose significantly (sig. 0.028) decreases over a three month period on combined conventional and Ayurvedic medication while conventional medication alone was not statistically significant (sig. 0.821). There were no statistically significant changes in conventional therapy group or combined therapy for Hba1c reiterating the need for an extension of time to view a long term assessment of both treatment methods. There were no statistically significant changes in conventional therapy group or combined therapy for both BMI reiterating the need for an extension of time to view a long term assessment of both treatment methods.

Key Words

Ayurveda, Fasting Blood Glucse (FBG), Hemoglobin A1c (Hba1c), Body Mass Index (BMI), World

Author: Rowan Barton

Supervisor: Valdis Pīrāgs

KOPSAVILKUMS

AJŪRVĒDA INDIVIDUALIZĒTĀ CUKURA DIABĒTA TERAPIJĀ

Ievads:

Saskaņā ar PVO datiem, diabēta pacientu skaits palielināsies no 171 miljona 2000.gadā līdz 366 mijoniem 2030.gadā. Ajūrvēda ir viena no vecākajām medicīnas sistēmām pasaulē, kas jau vairākus tūkstošus gadu nodarbojas ar cukura diabēta diagnostiku un ārstēšanu. Ir svarīgi identificēt, vai kombinējot konvenciālo ārstēšanu ar ajūrvēdu, pastāv potenciāls samazināt cukura diabēta slimības slogu visā pasaulē.

Mērķis:

Pētījuma mērķis bija izvērtēt uz *dosha* balstītas *Prakriti* un *Vikriti* atšķirības pacientu mērķa grupā. Literatūras apskatā identificēt biežāk izmantotos Ajūrvēdas medikamentus diabēta gadījumā un to terapeitiskos efektus. Izpētīt Ajūrvēdas konsultāciju iezīmes 3 mēnešu izpētes perioda laikā. Noskaidrot vai ajūrvēdas konsultācijas izmainīja ārstēšanas taktiku un vai 3 mēnešu laikā novēroja statistiski ticamas atšķirības salīdzinot GTD, Hba_{1c} un ĶMI.

Materiāli un metodes:

Definējot iekļaušanas un izslēgšanas kritērijus, tika veikts randomizēts divu grupu, placebo un kontroles grupas, prospektīvs pētījums, kurā tika iekļauti 32 pacienti - 21 pacients pirmajā un 11 pacienti otrajā grupā. Pirmās pētījuma grupas pacienti lietoja Ajūrvēdas medikamentus kombinācijā ar konvencionālu ārstēšanu un otrās grupas pacienti lietoja placebo medikamentus kombinācijā ar konvencionālu ārstēšanu. Rezultāti tika statistiski apstrādāti, lietojot SPSS 11.5 versiju.

Rezultāti:

Sākot analizēt datus,bija skaidrs, ka *Vikritii* un *Pakritii* grupās ir pārāk daudz apakšgrupu. Veicot One-way ANOVA analīzi *Pakritii* apakšgrupās netika novērota statistiski ticama atšķirība nosakāmajos lielumos, jo bija pārāk maz analizējamo paraugu. Vidējā tukšas dūšas glikoze kontroles grupā bija 157mg/dL,vidējais Hb1Ac bija 8% un vidējais ĶMI bija 27 kg/m2. Pētījuma grupā tika novērota spēcīga korelācija starp *Pitta* un *Kapha* grupu medikamentiem. Trīs mēnešu periodā 23 no 32 (74%) pacientiem tika veiktas izmaiņas terapijā, bet 14 pacientiem izmaiņas terapijā netika veiktas. Pāru atšķirības pamata GTD - 3M

GTD pētījuma grupai bija statistiski ticama (0.028), kamēr placebo grupā tā bija 0.821. Pāru atšķirības pamata Hba_{1c} – 3M Hba_{1c} pētījuma grupā bija 0.664 un placebo grupā 0.632. Pāru atšķirība pamata ĶMI - 3M ĶMI pētījuma grupā bija 0.233 un placebo grupā 0.558.

Secinājums:

Nepieciešami precīzāki iekļaušanas kritēriji, lai veiktu stratificētu nejaušās izlases pētījumu gan *Prakriti*, gan *Vikriti* apakšgrupās. Tas nodrošinātu adekvātu pacientu skaitu abās apakšgrupās, pirms statistiskās analīzes veikšanas. Tika pamatota korelācija starp ĶMI/aptaukošanos un 2.tipa cukura diabētu. Starp Ajūrvēdas speciālistu un pacientu veidojas ilgstošas attiecības, jo, lai nodrošinātu visaptverošu pacienta aprūpi, nepieciešamas regulāras vizītes. Trīs mēnešu laikā glikoze tukšā dūšā statistiski ticami (sig. 0.028) samazinājās kombinējot konvencionālo un Ajūrvēdas medikamentozu terapiju, kamēr izmaiņas lietojot konvencionālu terapiju nebija statistiski ticamas (sig. 0.821). Netika novērotas statistiski ticamas izmaiņas Hba_{1c} līmenī, salīdzinot kombinēto un konvencionālo terapiju, bet, lai precīzāk interpretētu šos rezultātus, būtu nepieciešams ilgāks pētījuma periods. Netika novērotas statistiski ticamas izmaiņas ĶMI līmenī, salīdzinot kombinēto un konvencionālo terapiju, bet, lai precīzāk interpretētu šos rezultātus, būtu nepieciešams ilgāks pētījuma periods.

Atslēgvārdi: Ayurveda, Glikoze tukšā dūšā (GTD); A1c hemoglobīns (Hba_{1c}), Ķermeņa masas indekss (ĶMI).

Autors: Rowan Barton

Darba Vadītājs: Prof. Valdis Pīrāgs

1. INTRODUCTION

Sugar in the twentieth century is considered a popular dietary necessity for many people and is an important staple of their diet. Whether a conscious or unconscious choice it presents itself in all shapes, packages and forms. Christian Bovee quotes “Our forefathers did without sugar until the 13th century, without coal fires until the 14th, without buttered bread until the 16th, without tea or soup until the 17th, without gas, matches or electricity until the 20th.” Bovee highlights that the human species survived without refined versions of sugar which in fact spanned thousands of years. As the human race advanced and modernised, the dietary habits of the worlds population has evolved from consuming raw, natural, unprocessed foods to highly processed products depleted of the original natural minerals, fibres and nutrients now being high in carbohydrates, proteins and fats. The character Will from the popular 90’s TV series Friends quoted, “If it's no fat, no sugar, no dairy... it's no good, throw it out!”

Blood sugar today controls the daily routine of millions of people worldwide who suffer from Diabetes Mellitus (DM). Blood sugar is vital to the health because it is an important source of energy for the cells that make up a person’s muscles, tissues and especially the brain as its main source of fuel. On the contrary in excessive levels blood sugar can lead to diabetes mellitus and its sequelae. Chronic diabetes conditions include type 1 diabetes and type 2 diabetes. A potentially reversible diabetes condition includes pre-diabetes presenting with blood sugar levels higher than normal but not high enough to be classified as diabetes. Furthermore there is gestational diabetes which occurs during pregnancy and can result in fetal and labour complications. It either resolves after the baby is delivered or progress’s into becoming type 2 diabetes. The sequelae of chronic diabetes are enormous, with the disease of long term high blood sugars resulting in multiple end organ damage including of the heart, kidneys, brain, blood vessels, retinas, peripheral nerves. These are aptly named conditions such as Diabetic Cardiomyopathy, Diabetic Nephropathy, Diabetic Neuropathy, Diabetic Retinopathy, Diabetic Encephalopathy and Macrovascular complications (Holt and Cockram et al. 2010).

According to V. Mohan et al. from the Madras Diabetes Research Foundation including C. Varghese the Indian representative to the World Health Organisation, it is stated that India has the largest number of diabetic patients. The predicted number of patients is expected to reach 69.9 million by the year 2025. Why this epidemic of diabetes concentrates itself in India is

under constant study concluding with the description of the predisposed "Asian Indian Phenotype" not only to diabetes mellitus but also premature coronary artery disease. This refers to certain unique clinical and biochemical abnormalities in the race which includes increased insulin resistance (prediabetes), greater abdominal adiposity despite lower body mass index, lower adiponectin, higher high sensitive C-reactive protein levels and genetic factors (Ramachandran and Snehalatha et al. 2001).

In addition to the Asian Indian Phenotype, the worldwide increase of the westernised lifestyle has a profound effect in the development of DM type 2. Dietary patterns, decreased physical activity and urbanisation leads to the higher prevalence in urban populations. The most disturbing trend is the shift towards a younger onset of diabetes that could have long lasting adverse effects on a nation's health and its economy (Hu 2011). This 'forecast' for the epidemic in India is proof that early identification of at-risk individuals using simple screening tools and appropriate lifestyle intervention would greatly help in preventing or postponing the onset of diabetes and thus reducing the burden on the community and the nation as a whole.

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes was projected to rise from 171 million in 2000 to 366 million by 2030 (WHO 2015). The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between 2000 and 2030. The most important demographic change to the prevalence of diabetes across the world appears to be the increase in the proportion of people over the age of 65. These findings indicate that the "diabetes epidemic" will continue even if levels of obesity remain constant. Given the increasing prevalence of obesity, it is likely that these figures provide an underestimate of future diabetes prevalence (Holt and Handley 2012).

In the year 2004 according to the World Health Organisation (WHO) approximately 347 million people worldwide have diabetes. At this time an estimated 3.4 million people died from consequences of high fasting blood sugar worldwide and this number has been increasing year by year. It has been reported that greater than 80% of diabetes deaths occur in low and middle-income countries. WHO projects that diabetes will be the 7th leading cause of death in 2030. In the year 2010, healthcare expenditures on diabetes accounted for 11.6% of the total healthcare expenditure in the world. According to "report" 95% of the countries will

spend 5% or more, and about 80% of the countries will spend between 5% and 13% of their total healthcare dollars on diabetes. The report states that global health expenditures to prevent and treat diabetes and its complications was USD376 billion. By 2030, this number will exceed some USD490 billion.

It is evident there must be a global interventional initiative that can be successfully implemented, as the world will not be able manage the economic impact of the increased number of patients across a wider age range. Not only this, but current modern medicine regimes to treat DM type 2 is substandard, as it is uniform for all karyotypes and ethnicities of people resulting in resistance to medications and ineffective long term results. Research is underway in different countries across the world, for example, researchers in China have identified current sub standard diabetic therapies and are contemplating how to best manage the future diabetes epidemic (Chang 2001).

Ayurvedic medicine is one of the world's oldest medical systems. It originated in India over 3,000 years ago and remains one of the country's traditional health care systems. The term "Ayurveda" combines the Sanskrit words *ayur* (life) and *veda* (science or knowledge). Many Ayurvedic practices predate written records and were handed down by word of mouth. Three ancient books known as 'The Great Trilogy' were written in Sanskrit script more than 2,000 years ago and are considered the main texts on Ayurvedic medicine*; Caraka Samhita*, *Sushruta Samhita*, and *Astanga Hridaya* (Wujastyk 1998). Its concepts about health and disease promote the use of herbal medicines, special diets and other unique health practices. Ayurvedic medicine uses a variety of products and techniques to cleanse the body and restore balance. As a holistic healthcare system, the science of Ayurveda can be viewed as an umbrella discipline of many modern-day alternative therapies. The aim of Ayurvedic medicine is to integrate and balance the body, mind and spirit. This is believed to help prevent illness and promote wellness (Cavanagh et al. 1004).

Modern medicine is the science, or practice of, the diagnosis, treatment and prevention of disease. It encompasses a variety of health care practices evolved to maintain and restore health by the prevention and treatment of illness. Modern medicine's availability and clinical practice differs across the world due to regional differences in culture and technology (Warrel 2003). Modern scientific medicine is highly developed in the western world, while in developing countries such as parts of Africa or Asia rely more heavily

on traditional medicine. Traditional medicine has limited evidence and efficacy due to the socioeconomic standards of these countries and lack of scientific institutes at recognised first world standards. This combined with education of practitioners who have not required formal training leave many to doubt the validity of traditional medicines. Just as these countries are not of first world standards on health care and health analysis, one would be foolish to ignore thousands of years of medical trial and error due to a lack of statistics on paper. Even in the developed world however, evidence-based medicine is not universally regarded in clinical practice; for example, a 2007 survey of literature reviews found that about 49% of the interventions lacked sufficient evidence to support either benefit or harm (WHO 2002). Though much of India itself is still in poverty it has a booming middle and high class that is starting to break through the economic chains of the past and is expanding in all aspects of first world society including reaching world standards in scientific developments and health research. Due to this, over recent time we are seeing newly researched evidence-based studies in Ayurvedic treatments emerging into health research circles, exciting worldwide interest.

2. HYPOTHESIS

That the Ayurveda treatment of type 2 diabetes is based on an individualised approach according to specific subtypes of patients.

3. AIM

To assess the diagnostic tools used in evaluation of type 2 diabetes with an individualised Ayurvedic approach and subsequent personalised treatment strategy.

TASKS

- To evaluate dosha based *Prakriti* and *Vikriti* differences in the target patient base.
- To identify common Ayurvedic diabetic medicaitons currently used and their known medicinal effect from literature.
- To identify if during Ayurvedic consultations changes to treatment regieme occurred.
- To identify statistical differences in three month baseline values of Fasting Blood Glucose, Hba_{1c} and BMI.

4. LITERATURE REVIEW

4.1. AYURVEDA AS A HOLISTIC SYSTEM MEDICINE.

Ayurveda has a profound philosophical background and comprehensive understanding of life with a history of more than 5000 years. Doctor Gerrit Jan Meulenbeld, dutch professor of Indology, psychiatrist and sanskritologist in his work "Studies on Indian Medical History" says: "*In my view, Indian medicine is thoroughly embedded in the culture of the subcontinent and cannot adequately be studied and understood without acquaintance with its history and ways of thought"* (Meulenbeld 2001). As Ayurveda does not follow the same structure and guidelines as modern medicine, there are important concepts to explain and understand before this literature review can begin. Ayurveda according to the classification of American National Center for Complementary and Alternative Medicine (NCCAM) belongs to the Whole Medical Systems (NNCAM 2007). No one person is like another. Each of us has an individual physiological composition and an individual constitution. Our health is influenced by our origins, our talents, our behaviour, our environment, by all that we see, hear, feel and experience. Ayurveda therefore considers all aspects of life in its recommendations for lasting, holistic health. It is based on the theory that illness results from the imbalance of the body's life force. According to Ayurveda, the entire cosmos, nature and man are pervaded by three fundamental forces known as the 'three doshas'. They control all physical functions and determine the specific dosha type. The individual distribution of the three doshas characterises the different features of our respective personalities, our likes and dislikes, our strengths and weaknesses. If the dosha combination is out of balance this can encourage disease processes to manifest resulting in ill health. Thus the purpose of an Ayurvedic physician is to evaluate patients by questioning them about symptoms, behaviour, and lifestyle; observing their overall appearance, including the eyes, tongue, and skin, taking their pulse and checking their urine and stools. When an imbalance is detected then a specific treatment regiment can be made for the patient. These treatment regiments unique to Ayurveda include a combination of diet, herbs, massage, meditation, yoga, and therapeutic elimination (NCCAM 2009).

4.2. MEDICAL PRACTICES IN MYTHOLOGY.

Throughout history, illness has been attributed to witchcraft, demons, adverse astral influence or the will of the gods. All human societies have medical beliefs that provide explanations for birth, death and disease. The ancient societies from Egypt, Babylonia, India, China, Greek and Rome have evidence unveiled of many different forms of

medicine. Ayurevedic medicine belongs to the subcontinent of India. Its two most famous texts belong to the schools of Charaka, born c. 600 BCE, and Sushruta, born 600 BCE. The earliest foundations of Ayurveda were built on a synthesis of traditional herbal practices together with a massive addition of theoretical conceptualizations, new nosologies and new therapies dating from about 400 BCE onwards, and coming out of the communities of thinkers who included the Buddha and others. Alike all other forms of ancient medicine part drew inspirations from the beliefs in Gods and their supernatural powers and influences on man. From the Hindu religion Lord Vishnu appears in the form of Dhanvantari who in the deity of Ayurvedic medicine (Tirtha 2005). It is common practice in Hinduism for worshippers to pray to Dhanvantari seeking his blessings for sound health for themselves and others. The specific characteristics of Dhanvantari are that he has four arms each with a different purpose in healing. In one arm he holds a *chakra* for killing demons of the mind and body, the second a conch making the sound of "Om" the first sound of the universe used in therapy, the third he holds *kalasha* with the nectar of immortality and last he holds either medical herbs, medical books or a leech signifying purification of blood (Morgan 1994).

4.2.1. The ancient writings of the Ramayana.

The *Ramayana* writes about life in India around 1000 BCE and offers models in dharma (cosmic law and order) way of life (Manmatha 1891). The original *Ramayana* was a 24,000 couplet-long epic poem attributed to the Sanskrit poet Valmiki. Included among the verses are key Ayurvedic principles to healing and teachings. Concepts of Ayurveda that are described include the medical practise of court physicians for royal families, amputation, abortion, toxicology against poisons, the practise of the preservation of dead bodies, the use of alcoholic preparations and the examination of the dead and alive. Also included amongst the writings are many herbs that were and still are used in an array of treatments. Examples mentioned in Latin form include *Holarrhena antidysentrica, Terminalia arjuna, Azadirachta indica, Saraca asoca, Bauhinia purpurea, Pterocarpus marsupium* and *Alstonia scholaris* (Manmatha 1891).

4.2.2. The ancient writings of the Mahabharata.

Mahabharata has more than 74,000 verses, plus long prose passages, or some 1.8 million words in total, it is the longest epic poem in the world and is considered the second amongst the greatest epics of ancient India. In its immensity, it is thought that the Mahabharata's writings go back as far as 500 B.C.E but this is due to its size that the writings could have been collected over a long period of time. The Mahabharata is of immense religious and

philosophical importance in India. It is considered to be part of the Hindu itihasas, literally "that which happened," or sacred history. It describes different types of personalities and their psychology, socioeconomic and political conditions of the period (Ganguli 2003). As similar to the *Ramayana* there are references to Ayurveda including different varieties of medical and surgical treatments. The practice of medicine again is visited with examples of royal family physicians, toxicology in the treatment of poisons/venoms, descriptions of diseases, causative factors and treatment and practice of surgery including battle surgeons. Notably the description of all the eight main branches (*Ashtanga*) of Ayurveda can be read, which had been originally dated back to 1500 B.C.

The eight main branches of Ayurveda are mentioned in table 4.1:

Table 4.1. The eight branches of Ayurveda. (Tirtha 2005)

Kaya chikitsa	Internal Medicine
Shalya tantra	Surgery
Shalakya tantra	Otorhinolaryngology and Ophthalmology
Agada tantra	Toxicology
Bhoota vidya	Psychiatry
Kaumarbhrutya and Prasuti	Pediatrics and Gynecology
Rasayana	Geriatrics
Vajikarana	Fertility and Sexology

4.3. THE FUNDAMENTAL PRINCIPALS OF AYURVEDA

4.3.1. PHYSIOLOGY IN AYURVEDA (*SAREERA KRIYA VIJNANAM*).

Human physiology is the science of the mechanical, physical and biochemical functions of humans, their organs and the cells of which they are composed. The principal level of focus of physiology is at the level of organs and systems within systems. According to the Ayurveda, every individual is unique entity for knowing this uniqueness of every individual '*Prakriti Pariksha'* is essential. *'Prakriti Pariksha'* is the analysis of body and mind. The living body can carry on all the physiological activities normally as long as all its components are in a state of balance. The balancing forces of the body may be either qualitatively or quantitatively increased or decreased. Thus when there are imbalances this may lead to disease when mild, and possibly death when the balance is severely disturbed (Young 2007).

4.3.1.1. Composition of the body.

Atman is a Sanskrit word that means 'inner-self' or 'soul'. Brahman is quoted saying that "If atman is brahman in a pot (the body), then one need merely break the pot to fully realize the primordial unity of the individual soul with the plenitude of Being that was the Absolute." In Ayurveda *Atman* is an important concept to understand as when there are imbalances in one's *Atman* then this can also influence disease process further backing the concept of mind, body and soul holistic medicine. Here it is described that in every living being there is also *atman* present (Tirtha 2005). The body has been described as containing five material elements in the texts in the concept of *pancha bhutatmika*. These five elements can also be compared to the fingers of your hand. The thumb is attributed to space, the index finger is attributed air, the middle finger is to fire, the ring finger is to water and the small finger is to earth. Without the thumb one is termed as partially handicap as he/she is not able to perform all tasks properly. Likewise, Ayurveda says without space element nothing else can exist, as space is the most important element for existence.

Ayurveda further has divided these materials elements into two groups one being *dravya* which is matter, or the biological forces which operate in the body, and the other is *shakthi* which is energy. Energy presents itself in different forms either substances enriched with energy and substances with little energy. These are further subdivided into three important groups of:

1. *Shakthi Roopa Dravyas* – these are three *doshas* (*Vata, Pitta and Kapha*).
2. *Shakthi Yukta Dravyas* – these are seven *dhatus* which act as energy exhibiting media.
3. *Shakthi Heena Dravyas* – theses are excretory products of metabolism, known as *malas.*

   (Vaghela et al. 2013)(Pole 2006)

All three are present into the body in their different forms thus constituting different organs and tissues.

4.3.1.2. *TRIDOSHA* concept.

As mentioned above, *Shakthi Roopa Dravyas* consists of three doshas of *Vata, Pitta and Kapha.* Together they form the *Tridosha* concept, which is fundamental principal in Ayurveda. As each living person is unique, their bodily composition of dosha's are different and is formed as early as the time of embryogenesis (Hankey 2001). As a person grows and is exposed to different environmental factors such as climate, lifestyle, stressors and psychological experiences, the homeostasis between these three doshas may change to form a

new healthy equilibrium. Alternatively this equilibrium can be unbalanced from the same circumstances, resulting in disease process. Different bodily functions can be made of different combinations of the three doshas thus different medical treatments are made to address the particular doshas involved. This is why the concept of the tridoshas is important for the understanding of the body's physiology, diagnosis, treatment, lifestyle and dietary recommendations in Ayurveda (Lad 2002).

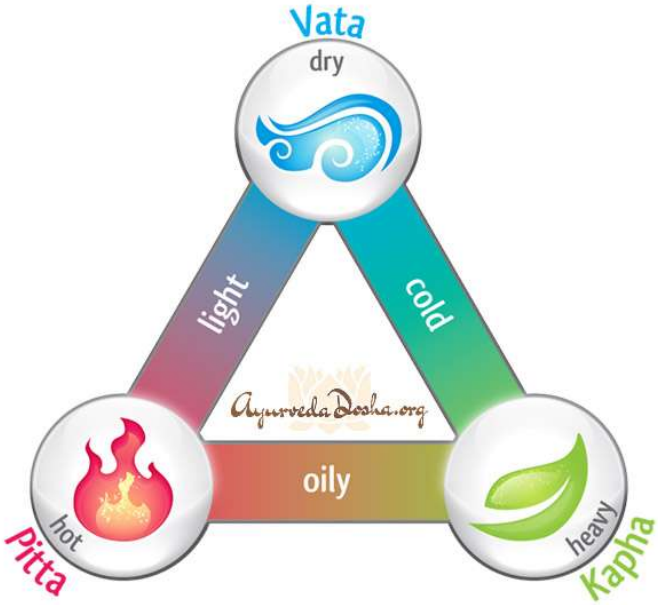


Figure 4.1. Tridosha concept. (Ayurvedadosha 2015)

4.3.1.3. *VATA dosha.*

The main function of the *Vata* is energy force and nothing can move without it, including the other dosha's, thus it is considered the most influential dosha. In classical literature *Vata* dosha's movement function is constituted of the elements of air and space and parallels the concept of the *Vayu* priciple of force in the universe (Naik 2015). Bodily processes involving the Vata Dosha include:

- The respiratory system, which involves air and movement.
- The movement of blood and its circulation.
- The gastrointestinal system and the movement of food once it has been ingested.
- The cardiovascular system with the beating of the heart together with the movement of lungs.
- The movement of thoughts through the mind.
- The sense of touch.
- The sense of hearing.

- The movement of the muscle.
- The abilty of speech and communication.
- The nervous system of nerve impulses around the body.
- Somatic activities and sensations of the body including the intelligence that channels perceptions through the appropriate sensory organs, converts them into internal phychological events, and then orchestrates the appropriate response via the organs of action (Hope-Murray 2013).

As Vata is so influential in the proper functioning of the body it is evident that when there is an imbalance there is the potential to have many functions of the body disrupted. The more severe the imbalance the greater the consequence and damaging to the body's health therefore oragn systems of the body can be compromised and fail resulting in serious illness such as hypertension, myocardial infarction, unstable angina, stroke as well as milder diseases such as mild upper respiratory tract infections, mental stress, fatigue etc. *Vata* is subdivided in to 5 parts: *Vyana, Samana, Prana, Udana, Apana*.

Table 4.2. *Vata* classification and functions.

***Vata* classification and examples of actions**	**Examples of *Vata* disorders**
Vyana or "omnipresent air," integrates all *Vatas*. It helps to balance the other four *Vayus*, and is present throughout the body. It influences the nervous system, the blood circulation, the functions of joints and muscles.	Muscle twitching, rigidity, profuse sweating of hands and feet, blood circulation disorders, hypertension/hypotension, tachycardia, edema.
Samana aids digestion, vitality and balance. It is concentrated at the navel center for the transformative power of the fire element thus aiding food digestion, absorption and excretion.	Diarrhea, gastroenteritis, nausea, indigestion, anorexia, hyperperistalsis.
Prana is the life force and the term refers to a cosmic energy believed to come from the sun and connecting the elements of the universe. It is connected to vitality, respiration, circulation, motor-sensory functions, also to ability to think	Alzheimer's disease, Parkinson's disease, stroke, vestibular imbalance, epilepsy, congestive heart failure, depression, anxiety, paralysis.

and thermoregulation.	
Udana is the upward-moving breath, which directs the flow of prana from the lower to the higher planes of consciousness. An ascending and radiant force it is responsible for respiratory movements, mental strength, memory, intelligence, speech, salivation.	Addictions, psychosomatic diseases, schizophrenia, speech disorders, insomnia, asthma, loss of memory, premenstrual syndrome.
Apana is the downward and outward flow of energy from the body. Opposite to Udana it works from pelvis until the feet. It is responsible for excretion, ejaculation, micturation, menstruation, pregnancy and parturition.	Diarrhea, constipation, dysmenorrhea, miscarriage, varicose veins

(Tirtha 2005)

In conclusion *Vata* reinforces the connection between *atma* (soul), *manasa* (mind), *indriya* (sense organ) and *indriyartha* (object). The holistic approach to *Vata* imbalances in the body can result in the treatment all of these aspects in a patient.

4.3.1.4. *PITTA dosha.*

Pitta literary means heat. It is a combination of the elements Fire and Water and represents the concept of transformation and digestion. It is fire in the form of digestive enzymes that degrades the food that we eat transforming it into energy. *Pitta* also digests thoughts and feelings and assimilates them. *Pitta* is the force behind every biotransformation (Lad 2003). Also assists the vision, intellectual activity and grasping power of the brain, central thermoregulation on the level of hypothalamus. For example in the endocrine system the *Vata dosha* is in charge of dynamic processes of energy but the *Pitta dosha* is needed of potential power it holds especially in hormone production. Factors that can disturb Pitta include diets that contain too many hot or spicy foods, fasting or skipping meals, over-exposure to the sun or to hot temperatures, and emotional trauma. *Pitta* imbalance commonly may physically manifest as hypersensitivity of the skin, blotchy redness, rashes, hives, dry patches, inflammation, ulcers, acidity, excess heat, thinning hair, high blood pressure, and insatiable hunger. Acne or eczema may also develop (Tirtha 2005). Psychologically an out of balance *Pitta* person is prone to frustration, anger, jealousy, aggression, arrogance, irritability and impatience. Exacerbated *Pitta* can also become spiteful, critical and judgmental. Imbalances

in the digestive tract result in malfunction in the metabolism either with an increase or decrease of the digestive activity. For the patients with acute abdomen there is a greater risk for peritonitis. In the classical text Sushruta samhita (*Sushruta Nidana* 11/5, 11/15-16) it has been described that for the oncology patient with high *Pitta* dosha tumors are more infiltrative and more aggressive.

4.3.1.5. KAPHA *dosha*.

Kapha governs the structure of the body. It is the principle that holds the cells together and forms the muscle, fat, bone, tendon, fascia, nerve and blood vessel structure and stability. The primary function of *Kapha* is protection. The correct function *Vata* and *Pitta* can only be possible if the guiding structure of the *Kapha* is present. Thus when there is an imbalance the solid tissues are not able to preserve a normal structure which leads to the abnormal functions of *Pitta* and *Vata* progressing to disease. Imbalance of *Kapha* manifests in such diseases as osteoporosis, benign and malignant tumors, atherosclerosis, peripheral nerve demyelination, muscle atrophy, edema and anasarca conditions (Tirtha 2005). These disease processes fall into either one of two catagories being one the reduction of the quality or two the reduction of quantity of the *Kapha* structure. All three doshas are tightly bound in the bodies functions so it is typical for there to be multiple imbalances of all three in one disease (Lad 2003). However the beginnings of the disease usually is only attributed to one dosha imbalance. For example in the pathogenesis of DM type 2 *Kapha* dosha is predominant cause, but all the doshas are involved.

Table 4.3. Main qualities of *doshas.*

Doshas	Element	Qualities of each dosha	Support
Vata	Space and Air	dry, irregular, cold, rough, fast, viacious, energetic, flexible, light, minute and moving	All movement in the body
Pitta	Fire and Water	slighty unctuous, penetrating, hot, fiery, light, pungent, acidic, flowing and fluid	Biochemical processes
Kapha	Water and Earth	unctuous, cold, heavy, slow, steady, soft, oily, mild, smooth, sticky and solid	Form and lubrication

(Lad 2003) (Tirtha 2005)(Hankey 2001)

Table 4.4. *Dosha* functions.

Vata	Pitta	Kapha
Foundation of movement physiology	Metabolism and transformation of the body related to heat	Basis of structure and support of the cells, tissues and organs.
Muscle contraction	Coordinates digestion	Physical and biological strength and stability of the body's architecture
Gastrointestinal peristalsis and elimination	Biochemical energy exchange and reactions regulation	Constitutes substance to the structures
Inspiration and expiration of the lungs	Exocrine glands and endocrine hormone secretion	Natural tissue resistance
Blood circulation of heart and body	Regulates intracellular metabolic pathways of glycolysis, the tricarboxylic acid cycle and ATP metabolism	Composed of histological connections between and inside cells such as intracellular matrix, cell membrane, cellular receptors and synapses
Nervous system propagation		
Cell membrane ionic transport		
Transription and replication of DNA and cell division		

(Lad 2003) (Tirtha 2005) (Hankey 2001)

Table 4.5. Comparison of the state of balanced versus imbalanced *doshas.*

Vata	
Balanced	**Unbalanced/Excess**
Excellent energy level	Nonspecific fatigue, cold intolerance, worry, anxiety
Joyful and active life, energised with interest in life and natural curiosity	Decrease in joy and interest of life and Loss of energy

Natural respiratory function	Shortness of breath, dry cough, hiccup, disruption in respiratory movements
Natural sleep patern	Insomnia, interrupted or delicate sleep
Natural stimulation of digestive enzyme secretion	Deficiency of digestive enzyme excretion
Natural locomotion of digestion	Abnormal gastric locomotion leading to eating, digestion and elimination disturbances e.g. flatulance, bloating, constipation
Mental activity balanced and astute	Impaired memory, mental agitation, confusion
Natural drying of incidental mucous discharge	Incessant bodily discharge
Governs organs of perception and organs of action	Perception and action are inappropriate, senses are dulled and responses are untimely
Proper coordination of all body functions	Body functions are impaired or disorganized

(Lad 2003) (Tirtha 2005) (Hankey 2001)

Pitta	
Balanced	**Unbalanced/Excess**
Thorough digestion	Differentiation between nutrients and wastes is compromised
Healthy hair and usually slightly wavy	Dry, brittle hair, early graying and baldness
Normal vision	Impaired vision
Healthy skin	Unhealthy appearance, blotchy skin color, inflamed
Normal thermoregulation and thirst mechanism	Irregular fluid intake, fluctuating body temperature and abnormal perspiration
Focused, happy, stable	Scattered focus, anxious, irritable, obsessed
Systematic anabolism and metabolism of food	Irritable bowel syndormes, diarrhea, peptic ulcer, Gastric esophageal reflux disease, hemorrhoids, alcoholism
Disciplined, responsible, trustworthy, devotional towards life	Depleted spirituality
Stimulated upon intelect	Flatness in reasoning and mood

(Lad 2003) (Tirtha 2005) (Hankey 2001)

Kapha	
Balanced	**Unbalanced/Excess**
Well nutrituoned body with a devoloped musculature and strong bones	Undernourished body that is fatigued with ill defined musculature
Firm, strong physique	Formless, fragile physique, obesity
Enduring immunity, sexual vigor present	Prone to low immunity infections, sexual vigor diminished, impotency
Competant digestion, normal appetite	Delayed digestion, abnormal appetite
Strong joints	Weak joints inclined to injury
Calm, forgiving, understanding, patient	Intolerant, insecure, jealous, rude
Balanced moisture and lubrication	Too much moisture, increased mucous secretion

(Lad 2003) (Tirtha 2005) (Hankey 2001)

4.3.1.6. Ayurveda Body Type (*Prakriti)* and Disease Manifestation *(Vikriti)*

There are two distinct, yet inter-related, classifications of a person in Ayurveda. The first relates to the mind described above as *Doshas* and the second related to the body known as *Prakriti*. *Prakriti* is the individual constitution of a person and conveys the unique physical and psychological nature displayed (Svoboda 2005). In compassison to Western terminology, Prakriti is compared to the combination of somatotype and phenotype of a perosn. For phenotypic grouping Ayurveda uses *tridosha* theory of motion (*Vata*), metabolism (*Pitta*) and structure (*Kapha*) (Svoboda 2005). A person's unique *Dosha* is formed at conception and never changes. Likewise *Prakriti* is also formed at conception from the characteristics of each parent contributes and never changes. Knowing your *Prakriti* helps you to tailor a personal diet and lifestyle that can prevent disease and physical disorders and obtain peace of mind (Patwardhan and Bodeker 2008). It provides you with an understanding of your basic physical and psychological nature and how to keep it in balance with your surroundings, and this is the key to maintaining health. Unfortunately due to environmental exposures and unhealthy lifestyle influences, the misbalance produced results in the predisposition to disease processes resulting in *Vikriti* (disease manifestation). Throughout history races of human beings have migrated the world thereby slowly isolating particular traits in their genomes. Traits can be similar to one particular race, but be absent in another. Ayruvedic medicine recognises these differences and can accurately concentrate treatments on the influence of particular traits on a particular race's predisposition to disease. See Appendix 3 for *Prakriti* Questionaire.

A research article entitled Ayurvedic genomics, constitutional psychology and endocrinology by C.V.Rizzo Sieera studied the link between psychological somatotypes and the Ayurvedic concept of body types. He concluded that genopsycho-somatotyping related to a common basic birth constitution encoded in a person's DNA (Rizzo-Sierra 2011).

Table 4.6 *Prakriti* Classification

	Somatotype	**Description**
Vata	Ectomorph	Thin body, light sleep, restless, changeable, cold nervous, dry skin and hair.
Pitta	Mesomorph	Medium boned, moderate weight, sharp, good memory, fanatical, motivated, determined, heat sensitive.
Kapha	Endomorph	Large, broad body, heavy, excellent endurance, adaptable, e, walks slowly, long-term memory, cold natured.
Vata/Pitta	Mix of both	Mix of both
Vata/Kapha	Mix of both	Mix of both
Pitta/Kapha	Mix of both	Mix of both
Vata/Pitta/Kapha	Equal combination	Characteristics of all three

(Tirtha 2005) (Bhalerao et al 2012)

As seen in the table above there can be combinations of the three somatotypes. In these combination groups there are two predominant *dosha* constitutions and the has also a third *dosha* present but in smaller quantity. A person of almost equal amount of *Vata/Pitta/Kapha* is known to be *samadosha prakriti* thus having characteristics of all three resulting in a balanced health both physically and mentally. In an Ayurvedic practitioner's patient interview it is necessary to determine the patient's *Prakriti* to accurately diagnose and treat (Chatterjee and Pancholi 2011).

B.Prasher and collegues, using the phenotyping criteria described in Ayurveda, have analyzed peripheral blood samples of the Indian population of Indo-European origin for measuring genome wide expression levels, biochemical and hematological parameters. They carried out gene ontology and pathway based analysis in order to explore if there are differences amongst *Prakriti* types. B.Prasher selected three most contrast groups of constitutional types (*Vata, Pitta, Kapha*)

and found striking differences with respect to biochemical and hematological parameters as well as genome wide expression levels. Liver function tests, lipid profiles and haemoglobin levels exibited differences, also functional categories of genes showed differential expression in processes of transport, regulation of cyclin dependent protein kinase activity, immune response and regulation of blood coagulation (Prasher et al. 2008).

The *Prakriti* of an indivudual is determined by a patient examination and interview. The questions asked are specifically asked to determine which dosha's a patient can be can be assessed into. The challange of the practitioner is to unmask the patients real *Prakriti* through the disease manifestation (*Vikriti*) as the symptoms may hide it. As climatic and geographic location change for patients over a lifetime, an Ayurvedic physician must put more emphasis on the original *Prakriti* manifestations from the childhood until the changes occurred (Lad 1984). The specific question categories are shown in table 4.7:

Table 4.7. Questions asked in order to establish the *Prakriti* of the individual.

Question topics	**Vata**	**Pitta**	**Kapha**
Heat tolerance			
• Does hot weather disturb you?	Can tolerate heat	Cannot tolerate heat or too much sun	Cannot tolerate extreme heat or extreme cold, but can withstand moderate heat or cold
• In the summer months are you comfortable outside?	Prefers heat Can't tolerate cold, Feel comfortable without a fan or AC	Feels irritated without a fan or AC	
• Do you prefer air conditioning (AC) in the car or house?		Prefers comfortable in cooler surroundings	

Reaction to stimulus and ability to withstand irritation • Are you quick to anger? • Are you able to handle pressure or stress without getting upset?	Very prone to mood swings. Cannot tolerate stress. Can become stressed/irritated but recovering soon	Quick to anger with insensity. Moderate tolerance to stress	Very patient, able to withstand lot of stress. Balanced mindset.
Quality of sleep • How long time do you need to fall asleep? • How deep is your sleep?	Long time to fall asleep prone to being shallow and interrupted	Moderate time to fall asleep, less prone to interruption	Quick to fall asleep fast, long, deep, uninterrupted sleep
Food preferences • Which are your preferable tastes? • Do you give prefer cold or warm food?	Warm, sweet, salty and sour	Cold, sweet, bitter, astringent	Warm, spicy, bitter and astringent
Bowel habits • What pattern of bowel movement do you have and has it changed?	Hard stools, tendency towards constipation, straining during defaecation	Tendency to have loose stools with no straining. Defeacation can be twice or three times a day.	Semisolid, well formed feaces with no straining. Normal, regular bowel movement,

• What is the consistency of your stools?			

(Lad 1984)

4.3.1.7. The Five Elements (*Panchabhuta)*

According to Ayurveda all matter of the entire universe is composed of five different elements called *panchamahabhuta* in the atomic level. These elements are known as earth (*prithvi*), water (*jala* or *ap*), fire (*agni* or *tejas*) wind (*vayu*) and space (*akasha*) they are found in different proportions in all matter.

1) **Earth** is the solid aspect of matter and there are two types of earth one is Eternal or (*nitya*) which are in the form of atoms (*paramanu*). The other type is perishable (*anitya*) which exists in the form of work (*karya*) or at animate and inanimate levels. Symbolically speaking our body, sense organs are of the earth, which as a whole gets the form of life but those are perishable. As one dies and decomposes these elements come back to its original eternal form.

2) **Water** in its three forms of solid, liquid and gas is involved adherance and binding substances. In is integral in endothermic reactions and from the sense organ perspective we can touch it to feel and taste it as well.

3) **Fire's** essential character is to generate heat. All the exothermic reactions are result of the action of Agni during the collision of particles.

4) **Wind** can be felt as air, as we breath in or out or as it passes our skin. We feel the storm or strong breeze which are temporary but air at atomic level remains around us eternally. In the Purana there is a mention of 49 types of Maruts or winds. In the universe it provides the mobility of all substances.

5) **Space** in needed for the other elements to function. It is the carrier of sound be it man made or otherwise. Space is unique as it has only one character and as it is the only eternal element of the five elements it attracted the attention of various sages. It is between subatomic particles and between planets of the universe, space is everywhere.

As seen in table three all three doshas are made up of combinations of these five elements. As each person has characteritcs of the doshas then they will also have characteristics of the elements that make that particular dosha. Thus in medicine understanding the concept of *Panchabhuta* provides a better understanding of living beings and what approach in treatment to take in different disease processes (Lad 1998).

4.4.1.8. The seven fundamental elements that support basic body structure and functioning (*Dhatu)*

Table 4.8. The seven elements of *Dhatu*.

1. Plasma	*Rasa dhatu*
2. Formed blood cells	*Rakta dhatu*
3. Muscle tissues	*Mamsa dhatu*
4. Adipose tissue	*Meda dhatu*
5. Bone	*Asthi dhatu*
6. Bone marrow and nervous system	*Majja dhatu*
7. Reproductive tissues	*Shukra dhatu*

(Lad 2002)

These seven forms of tissue make up all tissues found in the human body each with a particular function. Similar to the doshas the the time of birth these are present and develop over a life time. Genetic diseases are also describes in Ayurveda where it was known that children could be born with abnormalities in these tissues types resulting in the manifestation of disease. The normal health and maintenance of the *Dhatus* are described to be upkept untill the age of sixty (Lad 1984). It was observed that they slowly undergo reduction in quantity and quality resulting in the process ageing and eventual death.

For the continued health and maintenance of the body's tissue Ayurveda uses the Sanskrit term *Rasa*. *Rasa* is observed on different levels begining with the absorbtion of nutrients in the gastrointestinal tract continuing in the blood stream to nourish each and every cell of the body. In the process of tissue maintance the term *Rakta* is used as the vital carrier of nourishment from one part of the body to the other and blood is the major component of *Rakta.* Thus when there is poor *Rakta* not only will the tissues being supplied will receive a lack of nutrients but also the waste products will not be adequately removed. These waste products

will build up resulting in the start of further disease complications such as problems of oxygenative stress, mutations in the cells, ischemia and atherosclerosis.

This tissue that governs muscles, tendons, skins, and various excretions of the body is known as *Mamsa*. More indepth examples of mamsa tissue includes striated muscles, unvoluntary muscles, tendons, fascia, pleura, peritoneum as well as pericardium, myocardium, epicardium and the uterus. Thus in a normal healthy being there is proper function of heart, lungs, the digestive system, reproductive system and sight. When mamsa is compromised the tissues become weakened and in muscles for example, there will be a decrease of voluntary and involuntary muscle power. Functions such as walking, running and ability to maintain body posture and cardiac contractility can be affected. Examples of disease processes that involve abnormal *Mamsa* include muscular atrophy and muscle weakness which leads to heart failure, decreased movements in gastrointestinal tract and even decreased ciliary movements in the trachea (Pole 2006).

Medas is a constituent of all adipose tissue and proteins providing lubrication, binding, nourishment and flexibility to tissues. On the cellular level *Medas* works in the storage of energy, provides nourishment and gives a binding property between cells. For example the integrity of the myeline sheath is necessary for the healthy funtion of the nervous system. In capsulated joints of the body medhas gives lubrication and flexibility to joints as the synovial fluid is primarily composed of *medo dhatu*. When there is an unbalancing of the medhas such conditions such as DM type 1 and 2, obesity, gangrene and nephrotic syndrome can manifest (Tirtha 2005).

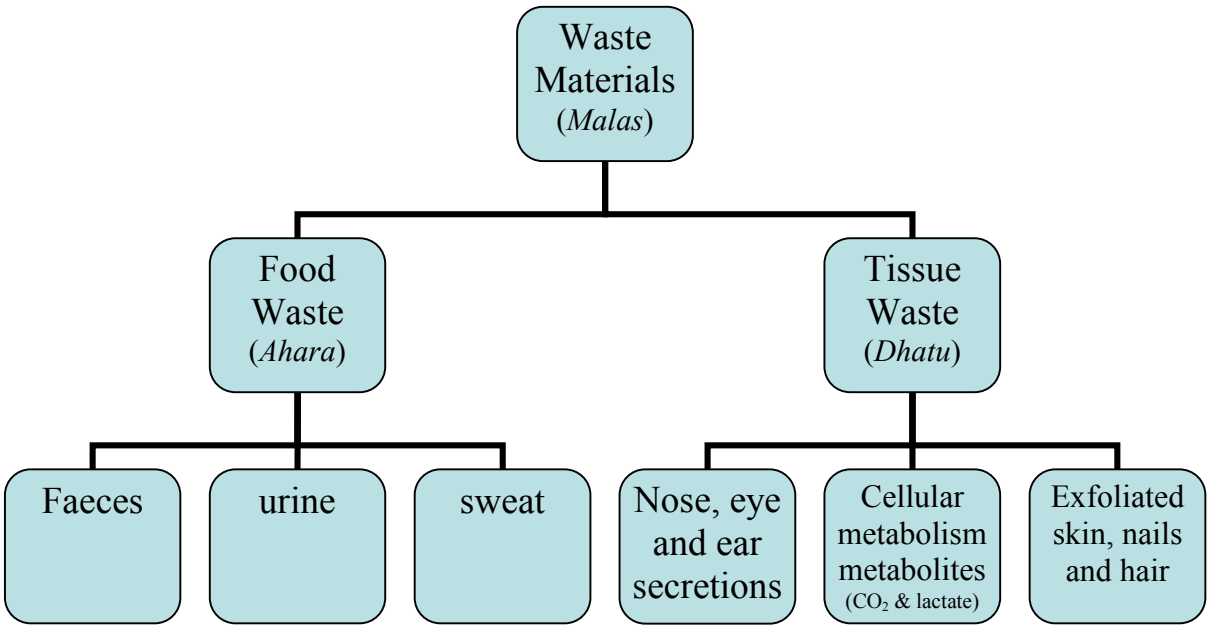
For the maintainence of the body's shape and structure providing stability and strength *Asthi* is responsible in the form of bones, tendons, fascia and muscles. Compromised *Asthi* is manifested in diseases such as osteoporosis, osteomeylitis, osteoarthrites and rheumatoid arthrites. Bone marrow known as *Majja* fills the inner part of the bone and is vital for hematogenesis. Blood according to Ayurveda contains all seven *Dhatus* and contains both *Rakta* and *Majja*. Thus when *Majja* is compromised disease processes such as osteoporosis, infertility, anemia as well as degenerative diseases associated with agening can manifest (Tirtha 2005). This final tissue type determines the reproductive capacity of a human being. This not only includes the spermatocyte of ova but includes all that is necessary for successful reproduction. It combines the endocrine and metabolic proceses involved to produce sex

hormones that stimulate the normal functionings of the reproductive system. Normal functioning relies on the purity of the other six *Dhatus* and on the quality of metabolism in the body. Abnormal functioning results in male infertility, female infertility, erectile dysfunction, decreased libido and sub fertile states.

4.3.1.9. Waste products of the body (*Malas)*

Malas are the substances or waste matter to be excreted out of the body. They consist of products formed as a result of various physiological activities of the body. The main excretory products of the body include the stools (*Pureesha*), urine (*Mutra*) and sweat (*Sveda*). These are also known as *Dushya* as they tend to be factors involved in the pathogenesis of disease by unbalancing the *doshas* (Lad 1984). The primary factor of waste substances contributing to disease manifestation is that they cause toxicity to the tissues *(Malinikarana*) of the tissues. In the body digestive fire (*Pachaka pitta*) converts food into two parts essence (S*ara*) and waste (K*itta*). Essence becomes solid and mixture of fluid with solid. *Kitta* becomes faeces and fluid both becoming both urine and sweat. (See figure 4.2). Thus three *Doshas*, seven *Dhatus* and these three *Malas* are considered the roots or three main supportive principles of the body. During the formation of *Rasa dhatu* the waste product is *Kapha* in the form of mucus. From *Rakta dhatu* there is formation of *Pitta*. While *Mamsa* is formed there is also a formation of earwax (*Kha mala*) at the same time. When *Dhatus* transform in to *Medas* sweat (*Sveda*) is being formed simultaneously. For *Asthi dhatu* nails and hair (*Nakha, Roma*) are considered the byproducts. During formation of *Majja dhatu* sebaceous secretions of skin are formed. *Shukra dhatu's* byproduct is *Ojas* (Lad 1984).

Figure 4.2. Classification of waste materials (*malas)*.



4.3.1.10. Vigor (*Ojas)*

Vigor in Sanskrit word is known as the word *Ojas* and it is the essential energy of the body which can be equated with the "fluid of life". Ayurveda describes *Ojas* as the sap of one's life energy which when is at normal levels represent a healthy immunity and when deficient results in weakness, fatigue and ultimately disease. Sushruta describes the absence or deficiency of *Ojas* in the body as a cause of wasting, decay and destruction (Sushruta samhita Sūtra stāna 15/20, 21, 22). Vigor is important for all life processes, physical and mental and is considered to be the instrumental for the functioning of immune system. In the immune system itself it helps in the synthesis of cytokines among others that is essential in the immune defence. *Ojas* protects *dhatus* from degeneration, and particularly it serves to impart a firm integrity to *mamsa dhatu* (Hope-Murray 2013) (Pole 2006).

4.3.1.11. Bodily Channels (*Srotas*)

In Ayurveda Srotas is translated to mean channels or pores and are present throughout the visible body, as well as at the subtle level of the cells, molecules, atoms and subatomic strata. It is through these channels that nutrients and other substances are transported in and out of our physiologies. It is also through these channels that information and intelligence spontaneously flow. They are the systems that carry certain liquids, impulsions and actions. When the flow of appropriate nutrients and energies through these channels is unimpeded, there is health thus when there is excess, deficiency, or blockage in these channels disease manifestation can take place. Examples of these channels are the Respiratory Channel (*Pranavaha Srotas),* Metabolic Channel *(Rasavaha Srotas)* and the circulatory channel (*Raktavaha Srotas*) (Hope-Murray 2013).

4.3.2. The fundamental principles of pharmacotherapeuics in Ayurveda (*Dravyaguna Vijnana*)

Pharmacotherapeutics known as *Dravyaguna* in Sanskrit was first was evident in the ancient writings of the Charaka. In the Charaka it describes substances that are beneficial and harmful to humans. These substances may work for or against the *dravya, guna* and *karma* aspects of health. Narahari in 17th century AD allocated Dravyaguna Shastra to be a separate specialty in itself. As Ayurveda is a holistic science, pharmacotherapeutics is still an important basis of therapy but pharmacotherapeutics as the sole treatment is not used. Below in table 4.9 are the seven aspects of *Dravyaguna* which will be described in detail in the following sections.

Table 4.9. Main topics of pharmacotherapeutics in Ayurveda.

Dravyaguna Shastra describes seven topics about drugs	
1) Dravya	Drug
2) Rasa	Taste
3) Guna	Physical property
4) Virya	Potency
5) Vipaka	Drug metabolism
6) Prabhava	Nonspecific activity or special action of the substance which cannot be explained by it's qualities
7) Karma	Pharmacological action

(Pole 2006)

4.3.2.1. Substance (*Dravya*).

Dravya refers to the substance of which something is composed and like all substances it can have many different kinds of properties (Pole 2006).

Drayva is classified into three categories:

1) According to source:
   a) Inorganic (*Bhauma*)
   b) Animal Products (*Jangama*)
   c) Plants (*Audbhida*)

2) According to use:
   a) Food (*Ahara*)
   b) Drugs (*Aushada*)

3) According to action:
   a) Aggravating (*Kopana*)
   b) Pacifiing (*Shamana*)
   c) Homeostatic (*Svasthahita*)

4.4.2.2. Taste (*Rasa).*

Taste in Auyrveda plays an important role in treatment as different tastes convey particular therapeutic properties. To categorise taste, six different forms are described in Table 4.10:

Table 4.10. Classification of Tastes (*Rasa)* - therapeutic uses according to taste.

	Taste	*Rasa*	Therapeutic uses
1.	**Sweet**	*Madhura*	*Vata* and *Pitta* disorders, deficiency of semen, geriatric conditions, agalactorrhea, habitual abortions.
2.	**Sour**	*Amla*	*Vata* disorders, loss of appetite, dyspepsia.
3.	**Salty**	*Lavana*	*Vata* disorders, loss of appetite, expectorant cough, diuretic, dyspepsia.
4.	**Bitter**	*Tikta*	**Obesity and diabetes**, loss of appetite, fever, gastritis, skin diseases, dyspepsia, excessive discharges, pus, parasitic worms.
5.	**Astringent**	*Kashaya*	**Polyuria**, diarrhea, hemorrhage, wounds, respiratory disorders
6.	**Pungent**	*Katu*	**Obesity and diabetes**, Indigestion, loss of appetite, dentifrice, dysentery, spruce, antihelmintic, *Kapha* and *Vata* disorders, skin diseases cough, asthma, coryza.

(Tirtha 2005)

4.3.2.3 Properties (*Guna)*

Taste was described to have six different properties but there are many other properties of substances yet to be described. *Guna* is the property of a substance and is inseparable from *dravya* but *guna* does not have any action of its own (Lad 1984).

Table 4.11. Twenty properties of substances, paired according to its opposite.

Light	***Laghu***	Heavy	***Guru***
Hot	***Ushna***	Cold	***Shita***
Dry	***Ruksha***	Unctuous	***Snigdha***
Sharp, quick, fast	***Tikshna***	Dull, slow	***Manda***
Mobile, unstable	***Chala***	Static, stable	***Sthira***
Hard	***Kathina***	Soft	***Mridu***
Mucilaginous, slimy	***Pichila***	Clean, non slimy	***Vishada***
Rough	***Khara***	Smooth	***Shlakshna***
Gross	***Sthula***	Fine	***Sukshma***
Liquid	***Drava***	Viscous, solid	***Sandra***

(Lad 1984) (Pole 2006)

Each *dosha* has a particular set of characteristics and the functions of the dosha depend on it.

Table 4.12. Qualities if *doshas.*

Vata	***Pitta***	***Kapha***
cardinal attribute: mobile, unstable	**cardinal attribute: penetrating, quick**	**cardinal attribute: immobile, stable**
Dry	Slightly unctuous	Unctuous
Light	Light	Cold
Cold	Hot	Heavy
Rough	Foul smelling (*Visram*)	Slow in action
Fine or minute	Free flowing (*Sara*)	Smooth
	Liquid (*Drava*)	Mucilaginous, slimy (*Picchila or mritsna*)

(Hope-Murray 2013)

4.3.2.4 Potency (*Virya)*

Potency (*Virya)* is the dynamic property that enables a substance to have action upon the body and in medicine produces the required therapeutic effect. It is accepted by most of practitioners that there are only these two types of *Virya* (hot/exothermic and cold/endothermic) (Tirtha 2005).

4.3.2.5 Drug Metabolism (*Vipaka)*

Vipaka is the effects after the digestion of the drug. Drug metabolism is the action that changes the original taste and the form of particular medication. In Auyrvedic concept it is the taste of the substance after digestion or aftertaste that is ready for use. Once a drug has been metabolically digested it is then in its active form to undertake its mechanism of action. This is important in respect to dosha imbalance as therapeutic substances will have different tastes resulting in different drug metabolism. For example the original taste of honey (*Rasa*) is sweet (*Madhura)* and generally produces more *Kapha*, but its drug metabolism (*Vipaka)* is pungent (*Katu*) (Hope-Murray 2013).

4.3.2.6. Specific Action (*Prabhava)*

Prabhava is the action of a drug not understandable from the examination of its *Guna, Rasa, Virya* or *Vipaka*. Thus the drug produces a result, which is not in accordance with the constituents. For example, both *Ghee* (clarified butter) and milk are *Madhura rasa* (sweet taste)*, Guru* (heavy)*, Shitha* (cold) *Virya* and *Madhura vipaka*, but *Ghee* is *Deepana* (increases digestive fire *Agni*) while milk is not. This action of *Ghee* is considered as a *Prabhava* (Pope 2006).

4.3.2.7 Pharmaclogical action (*Karma).*

An active substance (*Dravya)* works upon the tissues of the body by the action of *Karma*.

Table 4.13. Active *Dravya* actions.

Anulomana	Due to incomplete digestion of food *Ama* is develops leading to accumulation of toxic substances. Substances with *Anulomana* removes and expels *ama* from the body and corrects the movement of *Vayu*. An example is the excess secretion of mucus in the nasopharynx.
Deepana	Metabolic power (*Agni*) of the digestive system increases.
Grahi	Metabolic power (*Agni*) increases as well as the drying of excess fluids and restriction of excessive bowel movements.

Pachana	Increases the digestion of toxins (*Ama*) and improves appetite.
Rasayana	Purifies and nourishes the body elements (*Dhatus)* and channels (*Srotases*).
Sthambhana	Acts as an antidiarrheal.
Vajeekarana	The libido can become increased.
Vamana	Spoiled or impaired *Kapha* is expelled by emesis.
Virechana	Spoiled or impaired *Pitha* is expelled by purgation.

(Tirtha 2005) (Puri 2003)

4.3.2.8. Ayurvedic Drug Characteristics.

There are four characteristics that Ayurvedic drugs may possess that improve the medicinal outcome. These characteristics are:

1. Efficacy: The Ayurvedic drug needs to have the desired effect of reducing the disease burden and/or curing the disease without adverse side effects.
2. Availability: The Ayurvedic drug needs to have easy availability in price and quantity so that the desired treatment population can benefit from its action.
3. Potency: The Ayurvedic drug needs to have a pharmacological potency to reach the desired effect. To reach this threshold the Ayurvedic characteristics of *rasa, virya, guna, etc.* must be in action to produce this desired pharmacological effect.
4. Pharmaceutical Forms: The Ayurvedic drug needs to be available in practical and easy to use forms for the patients convenience.

4.3.2.9. Incompatibility (*Virudha) between medications.*

The incompatibility between different types of medications taken at the same time must be monitored. As with typical pharmaceutical drugs, combinations between types can lead to blocking of action or undesired side effects. The Ayurvedic approach to drug interactions is more in-depth than the standard way and many more factors can be assessed. Charaka has described in detail incompatibility of substances in relation to *desha* (place), *kāla* (time), *agni* (digestion), *mātrā* (dose), *sātmyā* (suitability), *dosha e.g.Vata, Pitta, samskāra* (processing), *avasthā* (condition), *samyoga* (combination), *Hrid* (flavor) and *sampat* (potency). In modern times a more simple Ayurvedic classification is used as seen in table 4.14.

Table 4.14 Incompatibility types between medications

Action	Description
Mana-virodha	Quantitative incompatibility, in that quantity of the medications will affect the pharmalogical effects.
Guna-virodha	Physical and chemical incompatibility, in that combination of two or more drugs has opposite *gunas, rasa, vipākas, viryas* cancelling out the pharmalogical effect.
Karma-virodha	Pharmacological antagonism occurs when combinations potentiates the action, also know as synergism.

(Parameshvara 2005)

4.3.2.10. Dosage of medications

To achieve the holistic approach of treatment, different people of different constitutional types will have variations of dosages and even different first line drugs of choice. This is more prominent in Ayurvedic treatments than the standards of mainstream medicine. Many different considerations are taken to make sure no harm is done to the patient and the optimal treatments choices are made. Considerations include *dosha, agni, bala* (strength)*, dravya, kostha* (digestive power in gastrointestinal tract etc.) and in older texts by Shārngadhara, age and preparation type is included in the dosage calculation.

4.3.2.11. Preparation of Medicines *(Bhaishajya Kalpana)*

Medicines in Ayurveda are administered in different forms and the majority of medicines are used from natural resources such as plant parts, minerals and animal products. There are five primary preparations (*Panchavidha Kashaya Kalpana*) and methods of extracting the essence (*Oushadha Sara*) from the natural resources. Juice extract (*Svarasam*), Herbal paste (*Kalkam*), Decoction (*Kvadham*), Cold infusion (*Himam*) and Hot infusion (*Phandam*) are the five primary preparations and from these five all other preparations are made (Mishra 2004).

Juice Extract: This administration technique consists of the filtered juice extracted from raw natural materials. The materials are cleaned and crushed leaving behind a potent form of the drug. As it is in a heavy form with high potency, its use has to be monitored and controlled.

Herbal paste: This administration technique consists of cleaned herbs that have been crushed and ground with water or any prescribed liquids, then made into fine paste.

Decoction: This administration technique consists of 60g of cleaned, chopped and crushed raw drugs which are then cooked within 1200ml of water and when reduced to a fourth of its original volume it is known as *Kashayam*. It can be administered in this form but for easier administration it is commonly further reduced to half.

Cold infusion: This administration technique consists of 60g of powder that is paced in 300ml of cold water and left overnight, known as *Hima.* This preparation is useful in *Pitta* conditions, which require cooling *shita* applications. e.g.*Draksha* (Dry grapes) kept over night in cold water is administered in *Santapa* (heat in the body).

Hot infusion: This administration technique consists of 60g of powdered raw drugs that are left in 300ml of boiled water for little time, then filtered and administered (Savrikar and Ravishankar 2010).

Examples of other preparations used that are made out of above five main preparations may include**:**

- **Avaleha (*Lehyam)*:** This in composed of an Ayurvedic jam like preparation that is made by concentrating fluids from herbs with sugar palm sugar and honey. *Avaleha* preparations remain for longer periods and are used for long-term treatments.
- **Fermented fluid** (***Arishtam/Asavam)*:** This composes of herbal alcoholic preparations that consist of herbal decoction or boiled water, natural fermenting agents and medicinal powders. The mixture that remains is kept for a period of 30-45days closed in a container in a dark place. When it is ready for use it is firstly filtered (Savrikar and Ravishankar 2010).
- **Herbal powder** (***Choornam)*:** This is composed of herbs that have been cleaned and dried then they are powdered separately, ground into fine powder and mixed together.
- **Medicated Ghee** (***Ghritam)*:** This is composed of clarified butter that acts as a lubricant and is part of many Ayurvedic treatments. Ghee is combined specific herbal pastes and decoctions or with herbal juices at specific temperatures.
- **Medicated Oils** (***Tailam)*:** This is prepared by boiling oils with herbal juices, herbal pastes and/or with decoctions. There are three parts combined of oils, fluids and herbal pastes.
- **Metallic Preparations *(Bhasmam/Sindooram)*:** This is composed of metallic preparations in calcinated or incinerated form. The preparation constitutes of the purification of metals and minerals *(Sodhana)* and the incineration of purified metals and minerals in closed pots with herbs at high temperatures (*Marana)* which is repeated until the metals turn into fine burned ash (*Bhasma*) (Pole 2006).

- **Pills** (***Gulika/Gutika/Varti)*:** This is composed of raw drugs that are ground fine then combined with pastes, juices or water and rolled into a pill like form.
- **Sweet granules** (***Vatakam)*:** Palm sugar or sugar is combined with herbal powder in the form granules.

4.4 DISEASE AND HEALTH.

As described in the introduction, Ayurveda as a holistic science emphasises on treating a patient not only to heal the body but also the mind at same time. The World Health Organisation also states in its very own health definition that health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO 2002). In all beings, body tissues are metabolised and created on a continual cycle and in the Ayurvedic theory it is the intake and digestion of nutrition, which heals and builds new tissues. When there are imbalances of the mechanisms needed to rejuvenated and heal old tissues, wastes gather, bodily channels are blocked and over time diseases manifest (NCCAM 2009).

4.4.1. Etiology, pathogenesis and diagnostic tools from an Ayurvedic perspective

A medical Ayurvedic practitioner is trained in a five step analysis (*pancha nidana*) that entails a holistic approach to result in a thorough investigation, correct diagnosis and premium treatment plan. These five step processes has been used over generations and are mentioned in many classical texts such as Charaka samhita, Ashtanga hridayam and Madhava nidana. These five steps are:

1. Etiology of the disease (*Nidana*).
2. Signs and symptoms or nonspecific early manifestation of the disease (*Purva roopa).*
3. Manifestation of the disease with actual typical signs and symptoms *(Roopa).*
4. Exploratory therapy using the method of trial and error *(Upashaya).*
5. Pathogenesis of the disease including *dosha* imbalance (*Samprapti)*

(Pole 2006)

Healthy beings have *Dosha samya* which is the balance of all the three *doshas* but *nidana* is responsible for disturbing the *dosha* balance. *Doshas* can be influenced by different etiological forces that disturb the balance thus vitiating the *dhatus* and *malas* (Lad 1998). These disturbances can be mild or strong depending upon *dosha* similarity or dissimilarity and functions with etiological factors. A hyper condition is created by the disturbance resulting in

vriddhi but the opposite is also possible where a hypo condition is creases known as *Kshaya*. Disturbances to the doshas typically begin with a kind of trauma or first contact of causative agent with the tissue. In Ayurveda there are four successive stages of disease process seen in table 4.15.

Table 4.15 Disease Stages *(Samprapti)*

1. Incubation stage	*Sanchaya*
2. Flaring stage	*Prakopa*
3. Spreading stage	*Prasara*
4. Settling down stage	*Sthana Samsraya*

(Pole 2006)

During stage four when the disease has manifested in a particular location, the typical signs and symptoms appear according to that particular disease and location, this is known as *Vyakta* (Pole 2006). According to Ayurveda there are five different ways an etiology can manifest into disease but there is an overlap between subtypes thus more regularly they are categorised into three groups. These groups can influence the mind, body and soul of an individual.

1. Due to undesirable contacts of senses with their objects resulting in detrimental sensory reactions and imbalance of the doshas (*Asatmyedriyartha Samyoga)*.

Asatmyedriyartha Samyoga is further divided into three sub-categories:

1. *Mithya yoga:* This category reflects inappropriate stimuli that result in the person to be in a state of unease. This may include poor quality air, eating poor quality foods, verbal abuse or being inappropriately touched.
2. *Ati yoga:* This category reflects excessive stimuli that results in unease to a persons senses. Examples may include light that is too intense, noise that is too loud, smells that are too strong or pressure on the skin that is too forceful.
3. *Hina yoga*: This category reflects when there is deficient stimuli of any of the senses. The nose is devoid of smells, food is scarce in taste, the skin is absent of touch or the ears have unable sound to hear (Pole 2006).

2. Unnatural changes in behaviour resulting in unsuitable verbal, physical and mental activities (*Prajnaparadha).* According to Ayurveda teachings, if a person uses their body, spirit and language in a healthy positive manner then that person will be more resistant against illnesses. On the contrary if a person uses their body, spirit and language in an unhealthy negative manner then that person will be more prone to illnesses. (Pole 2006)

3. The influence of climate changes *(Parinama kala).* Climatic changes can strongly imbalance *doshas.* It has even been noted when changing from a warm environment of a house to the cold of winter outside can induce headaches in susceptible persons. Also the changes between seasons are the peak incidence of viral infections. The concepts of *ati-yoga, hina-yoga* and *mithya-yoga* already described also play a role in *Parinama kala.*

Table 4.16. Seasonal effects on *doshas*.

Summer	Kapha ↓ (alleviation)	Vata ↑ (accumulation)
Autumn	Vata ↓ (alleviation)	Pitta ↑↑ (aggravation)
Winter	Pitta ↓	Kapha ↑
Spring	Kapha ↑↑	

(Pole 2006)

4. Results of one's previous actions *(Karma* or *Samskara).*

5. Infections agents for example viruses, bacteria, parasites and protozoa *(Krimi).*

4.4.2. Diagnosis of the disease *(Roga Pariksha)*

In Auyrveda the concept of a three point diagnosis *(Trividhya Pariksha)* is used to arrive at a diagnosis:

1) **Observation *(Darshana)*:** Observed during the first encounter and impression a physician has with their patients. It is said that with the initial time period of meeting much can be evident about the state (mind, body, soul) of the patient.
2) **Touch *(Sparshana)*:** During the physical examination of a patient a physician evaluates temperature, tugor, elasticity, moisture and evidence of abnormalities. The patient's reflexes and degree of pain is also determined and evaluated.

3) **Questioning *(Prahsna)*:** The physician must be skilled at detailed questioning to determine from an array of information what is important and specific. This includes not only the physical signs and symptoms but also the psychological state of the patient. The range of details an Ayurvedic physician must examine includes:
   - The *dosha* of the patient, *Vata, Pitta, Kapha* or a mixture.
   - Determining the *Dooshya* including which *dhatus* and *malas* are involved in the patient's disease.
   - Determining the digestive power of the patient (*Agni).*
   - Determining the strength *(Bala)* the patient has.
   - Determining the constitution (*Prakriti)* of the patient.
   - Determining the age (*Vaya)* of the patient.
   - Determining the mental capacity *(Satva)* of the patient.
   - Determining the habits *(Satmya)* of the patient.
   - Determining the diet *(Ahara)* of the patient.
   - Determining the stage of the disease *(Rogavastha)* of the patient.
   - Determining the climatic season *(Kala*).

(Pole 2006)

Eight point diagnosis *(Ashta Sthana Pariksha*)

The eight point diagnosis is an older form of clinical examination covering more types of examination points. The eight points can be seen in table 4.17:

Table 4.17. Eight point diagnosis.

1	**Pulse**	*Nadi*
2	**Urine**	*Mutra*
3	**Faeces**	*Mala*
4	**Tongue**	*Jihva*
5	**Sound**	*Sabda*
6	**Touch**	*Sparsha*
7	**Eyes**	*Drik*
8	**Physique**	*Akriti*

(Rohit et al. 2012)

1. Pulse diagnosis (*Nadi Pariksha)*

Examination of the arterial flow helps the physician to understand the state of the three *doshas*. According to Ayurveda pulse diagnosis takes many years of practice and much concentration from the physician and the radial artery is the best artery to use. Characteristics examined include the volume or quantity of the pulse which depends on *Kapha*, the tempo and frequency depend on *Pitta* and the rhythm and regularity depends on *Vata.* The elimination of faeces and urine must be done first to eliminate wastes from the body. The physician on completion of the exam will detect the predominant *dosha* or *doshas*. The technique requires the physician's index, middle and ring fingers and he examines the left wrist in a female patient or the right wrist for the male patient. Examination is done for 30 beats three times with small intervals (Lad 2006).

2. Examination of Urine *(Mutra Pariksha)*

In this technique a sample of urine is collected in the early morning and placed in a dish. A drop of sesame oil is then placed in the centre of the dish. The physician observes the reaction and is able to determine if there are any *dosha* imbalance and prognosis. In prognostic interpretation if the oil sinks to the bottom, it is a sign of serious illness and all three *doshas* are weakened, but if the oil disburses then the patient's illness will be easy to cure. In determining *dosha* states, if the patient has a hypoactive *Vata* the oil floats the surface. If *Kapha* is imbalanced then the oil remains where it was and takes a shape of a sieve or a pearl. If *Pitta* is imbalanced then the oil takes shape of an umbrella or a ring. For the disease of diabetes mellitus due to the high content of glucose in the urine the dish would be placed outside to see if ants would be attracted to the glucose for food. Not only was the dish method used in urine diagnostics but also the quantity, frequency, colour, taste, viscosity and temperature. When there are multiple doshas involved these characteristics can be present in different combinations (Mishra 2004).

3. Stool Examination *(Mala Pariksha)*

People with *dosha* imbalance may have different characteristics of stools and each dosha has different predominant characteristics. The colour, quantity, shape, frequency, smell, temperature are important for diagnosis and in a healthy individual faeces are well formed, are light in weight, not slimy, have sufficient quantity, are eliminated without any strain generally one or twice daily.

- ***Kapha* disturbance:** The faeces are mixed with slime and undigested food, they have a less offensive odour, they are whitish in colour and the patient has frequent urges to defecate.
- ***Vata* disturbance:** Patient has frequent urges to defecate, the faeces are hard and dry, the patient has frequent constipation, the faeces consist of many small parts and are black or ashen in colour.
- ***Pitta* disturbance:** Defecation often is accompanied by a burning sensation in the rectum, the patient has an increased urge to defecate, the faeces are blackish yellow or yellowish and may be watery or mixed with blood. (Pole 2006)

4. Tongue Diagnosis *(Jihva Pariksha*)

A healthy individual has characteristics of the tongue that is reddish in colour, supple in texture, clear to see the surface that is without a coating. Different dosha imbalances have different presentations of the tongue:

- ***Kapha* disturbance*:*** An increased volume of saliva is produced, the tongue feels sticky and soft, the dominant taste in the mouth is sweet and salty and the tongue has a white film coating.
- ***Vata* disturbance:** The tongue lack moisture, it is cool to the touch, rough in texture, it has a coloured reddish-brown coating and the predominate flavour preference is sweet and tangy.
- ***Pitta* disturbance:** The tongue is covered with yellowish film, it is soft and feels slimy, is dark red in colour during acute inflammatory conditions and the predominate taste is bitter and sharp. (Lad 1984)

5. Examination of Body Sounds *(Sabda Pariksha)*

All forms of sounds that the body makes can be examined. These sounds can include the voice, sneezing, hiccups, intestinal sounds, belching and borborygmi. Each dosha has certain characteristics when imbalanced:

- ***Kapha* disturbance:** The patient's voice is lower in pitch than normal, the voice is not clear of sound and the patients speech might be interrupted due to mucous accumulation.
- ***Vata* disturbance:** The patient's voice can be shaky, hoarse and dry in sound.
- ***Pitta* disturbance:** The patient's voice is higher in pitch and loud in sound. (Tarabilda 1997)

6. Examination by Touch (*Sparsha Pariksha)*

The examination by touch differs between different dosha characteristics:

- ***Kapha* disturbance:** The skin of the patient feels sticky and there is excess perspiration.
- ***Vata* disturbance:** The skin of the patient feels rough and dry.
- ***Pitta* disturbance:** The skin of the patient is increased in temperature. (Frawley and Ranade 2001)

7.* Eye Diagnosis *(Drik Pariksha)

The examination of the eyes differs between different dosha characteristics:

- ***Kapha* disturbance:** The eyes of the patient lacks sparkle but are shiny and watery, the eyes are whitish in colour and seem immovable.
- ***Vata* disturbance:** The eyes of the patient express a presence of anxiety and seem dull and deep in their sockets.
- ***Pitta* disturbance:** The eyes of the patient seem intense expression, they have reddish or yellowish discharge at the corners and are photosensitive. (Lad 1984)

8.* Observing the Total Appearance *(Akriti Pariksha)

The examination of the total appearance of a patient differs between the doshas and are examined using a combination of all the above tests (Frawley and Ranade 2001).

4.4.3. Principles of Treatment *(Chikitsa*)

Treatment is defined as the medical care given to a patient for an illness or injury. In the Ayurvedic context it consists of correcting the imbalances between the *doshas,* thus returning the patient's body back to normal homeostasis (*prakriti)*. According to Ayurvedic text there are three aspects to treatment that should be addressed. The first aspect is the spiritual and psychological healing of the patient known as *Daiva*, the second is the cure with medicines of the disease known and *Manusha* and the third is the surgical treatment of a disease known as *Asura* (Lad 1998). These treatments are implemented by a medical team that must work together as a unit for the greater outcome to occur. This is known Chatushapada where the physician *(Vaidya)*, patient *(Rogi)*, medicine (*Dravya)* and nurse (*Paricharaka)* combine in the treatment. The physician is the most important part of the treatment as he or she has the greatest potential to influence the other people into working for the greatest outcome. According to the texts of the Charaka if the physician is corrupt and ill experienced the

treatment will suffer even when the other Chatushapada are working well. On the contrary when the physician is good and other *padas* are of poor quality there still is a chance for cure.

4.5. CORRELATION BETWEEN PRAMEHA IN AYURVEDA AND DIABETES MELLITUS

4.5.1. Diabetes (*Prameha)*

Prameha which has been correlated with DM has become a global problem in spite of advances in modern science. India has been projected by WHO as the country with the fastest growing population of diabetic patients. It is estimated that from 1995 to 2025, the number of diabetic patients in India will increase by 195% (WHO 2015). There is a set of complex clinical disorders with frequent abnormal micturition explained in great detail in Ayurvedic classics, which is collectively called *Prameha*. In many ways it can be correlated with obesity, metabolic syndrome and DM. The word *prameha* literally means "to flow" which is derived from the Sanskrit root "*Mih-Sechane*". "*Pra*" is excess in quantity and frequency. "*Mehanam*" is urination (Tiwari 2005). *Ashtanga hridaya* describes that condition *prameha* with following words: *prabhūta avila mūtrata* tranlated excessive turbid urine.

4.5.2. Etiological classification of *Prameha* (*Hetu Bhedas*)

In Ayurvedic texts (Charaka Samhita, Sushruta Samhita, Astanga Sangraha and Hridaya, Hareeta Samhita) *Prameha* has been described in three major categories:

A) **Etiological classification** *(Hetu Bhedas)*

1. *Sahaja/Jatah prameha* (Hereditary)
2. *Apathyanimittaja* (Acquired)

(Srinivas et al. 2014)

B) **Features of the body or physique** *(Deha prakriti)*

According to Charaka samhita the two types of prameha patients on the basis of their physique or body constitution are:

1. Sthula pramehi: Obese patients, similar to the patients with type 2 diabetes.

2. Krisha pramehi: Asthenic patients, corresponds to patients with type 1 diabetes.

(Srinivas et al. 2014)

C) **Doshic classification or as per urinary abnormality** *(Vikara bheda)*

Ayurveda describes Prameha as of twenty subtypes differentiated into clinico-pathological conditions produced out of specific *Doshas* and *Dushyas* on the basis of gross urinary characteristics and clinical manifestations. These pramehas are classified as types:

- *Vataja* pramehas – There are in total four vataja pramehas.
- *Pittaja* pramehas – There are in total six pittaja pramehas.
- *Kaphaja* pramehas – There are in total ten kaphaja pramehas.

Diabetes mellitus is termed as *madhumeha* and it is one of the four Vataja pramehas (Purkait and Bhattacharya 2012).The etiology of diabetes is multifactorial with all aspects not completely understood. Combining this with the holistic view that every individual is different and requires an individualised approach to treatment, the same etiological causes for one patient might not be the same for another. Figure 4.3 depicts the multifactorial factors that contribute to diabetes.

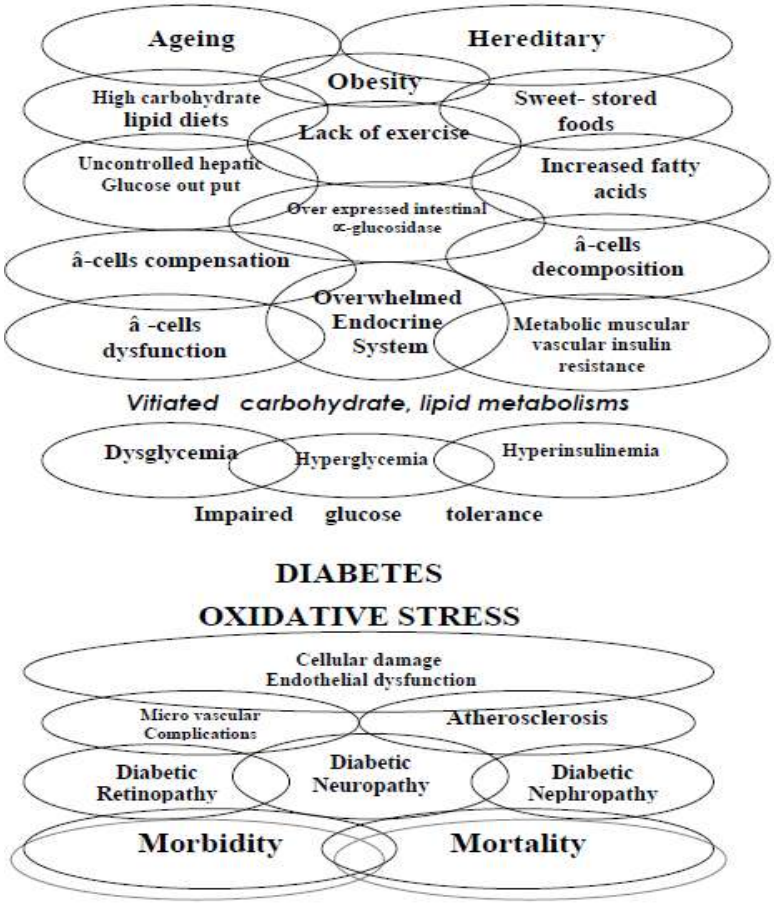


Figure 4.3. Wisdom of Ayurveda in perceiving diabetes: Enigma of therapeutic recognition Summary and sequence of events dealing with cause, course and complex interplay among various aspects which are either of natural, environmental, or hereditary origin, or the disturbances at various physiological and/or biochemical levels that direct

development of diabetic syndrome, ultimately responsible for morbidity and mortality due to the disease. (Tiwari 2005)

4.5.3. Doshic Classification *(Vikara Bheda)*

In the disease process of *Prameha* there are different levels of disease severity. During the beginning *Kapha* is in excess, producing a detrimental effect on fat and body fluids, resulting ultimately in a loss of *Kapha*. As the disease progresses the loss of Kapha allows the *Pitta dosha* to predominate, resulting in a detrimental effect on blood and ultimately in a loss of *Pitta*. This leads to an impairment of *Vata* resulting in the loss of vital substances out of the body through the urine.

If a patient is diagnosed and treated in the early stages of the disease process, then the disease is reversible and curable. *Kapha* predominance is associated with carbohydrate, lipid and protein metabolism disturbances accompanied by glycosuria and proteinuria, which can be easily controlled and cured. During *Pitta* predominance there is a tendency toward moderate hyperglycemia. Inflammatory, hepatic and gallbladder complications have an increased risk as well as lipid and blood abnormalities. During *Vata* predominance severe hyperglycemia with hypoinsulinemia is common. When there is no intervention into this disease process *Madhumeha* (type 2 diabetes) manifests which is incurable as it is the terminal stage of the disease. It is associated with loss of immunity and is in the *Vataja Prameha* stage, which is told to be incurable in Ayurveda (Purkait and Bhattacharya 2012).

4.5.3.1. Prediabetes equivalent to the *Kapha* stage of *Madhumeha*

During the *Kapha* phase there is a disturbance in the lipid metabolism, muscle metabolism and in body fluids collecting in the urinary bladder. There are a variety of dietary factors that contribute to the manifestation of the *Kapha* stage of the disease. These dietary factors contains certain types of grains (*Hayanaka, Chanaka*), barley (*Yavaka*), oats (*Avena sativa Linn*) and rice (*Mukundaka, Mahavrihi*). Other forms of foods that contribute can include peas (*Harenu*), legume (*Masha*), sesame (*Tila Palal*), sugar cane, milks and its products (*Payasa*), fresh wine and the meat of domesticated and aquatic animals. Lifestyle factors that contribute to this phase of the disease include a lack of physical activity, excessive sleep and sedentary habits. Psychological factors that influence this stage of the disease are people who are prone to, or have depression. (Jayaprasad and Sharavanan 2013)

There are subtypes and urinary clinical manifestations of the *Kapha* stage of the disease.

Theses include:

1. Chyleuria, albuminuria (*shuklameha)*: The urine is of a white colour and while urinating the patient feels erection of body hairs.

2. Solid precipitate in the urine (*sandraprasadameha*): A portion of the urine is turbid and a portion is clean when the precipitate is deposited in a pot and kept overnight.

3. Cold urine or urine is very sweet and abundant, with low temperature (*sitameha*).

4. Alimentary glycosuria (*ikshuvalikameha*): The urine has a taste that is like sugar cane and is very sweet. It is also cool, slightly viscid, turbid due to slimy substances.

5. Spermaturia (*sukrameha*): The urine is mixed with semen or the urine is similar to the quality of semen.

6. Lithuria (*siktameha*): The urine contains small particles like sand.

7. Phosphaturia *(sandrameha*): The urine is viscous or if urine is kept overnight a precipitate forms in the container.

8. Chronic nephritis (*udakameha*): The urine is watery or clear in a large quantity absent of odour. When the patient urinates they feel a cold sensation.

9. Albuminuria (*lalameha*): The urine is saliva-like urine or it is turbid and slimy. When between the fingers it forms thread similar to that of saliva.

10. Delayed and slow urination (*sainyameha*). (Jayaprasad and Sharavanan 2013) (Purkait and Bhattacharya 2012)

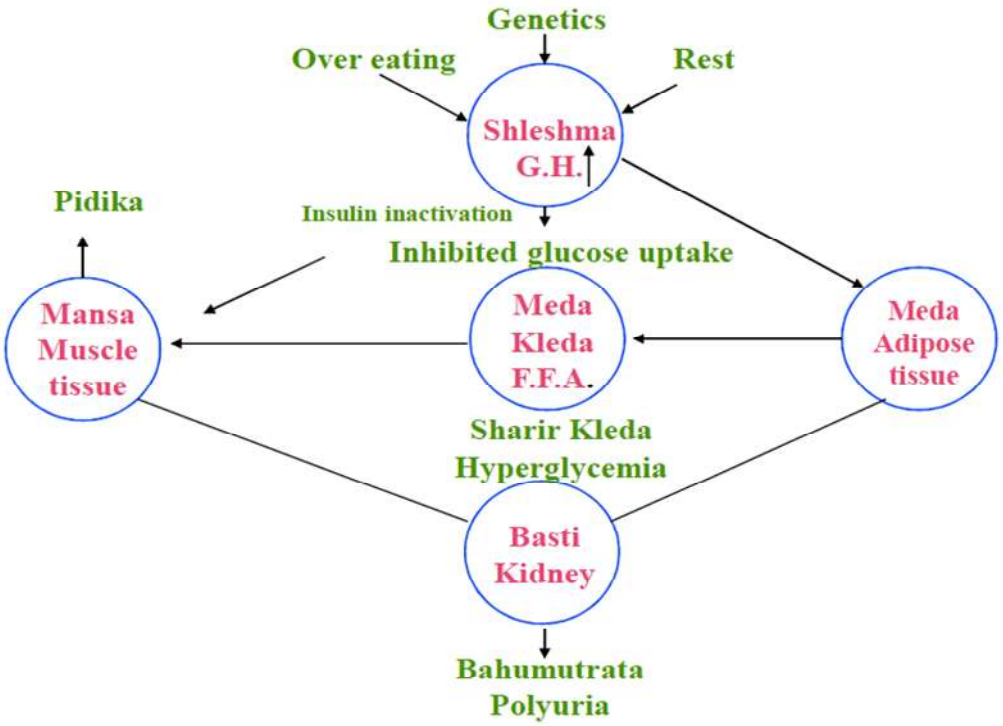


Figure 4.4. Pathogenesis of ***Kaphaja Prameha*** by professor H.M. Chandola, an author of many research papers on etiology, pathogenesis and treatment of *Madhumeha.*

4.5.3.2. Overt Diabetes Mellitus equivalent to the *Pitta* stage of *Madhumeha*

During the *Pitta* phase there is a disturbance in metabolism with heat causing disruptions of the *medas* hence the muscle metabolism and in body fluids collecting in the urinary bladder (Chandrasiri 2005). During this phase of the disease certain dietary factors can encourage its progression. Foods that are hot in potency, sour, excessively salty foods, alkaline and pungent can aggravate the disease. When a person eats before the previous meal is completely digested, when eating foods that are opposite in character such as drinking milk while eating salty food can also aggravate the disease. Certain lifestyle factors such as exposure to the intense heat of the sun or fire and having a lifestyle resulting the repetitive overexertion encourage a faster progression of the disease. Psychological factors during this stage of the disease have been noted that patients commonly harbour anger. There are subtypes and urinary clinical manifestations of the *Pitta* stage of the disease. Theses include:

1. Hematuria (*lohitameha*): The urine is of a deep red colour that contains blood and it is salty in taste and putrid in odor.
2. Alkanuria (*ksharameha*): The urine has a smell, colour and touch similar to alkali (ash).
3. Biluria (*haridrameha*): There is a yellow tinge of colour to the urine similar to the yellow of the herb turmeric. It is also pungent in smell and is associated with a severe burning sensation.
4. Indikanuria (*kaalameha*): There is a blackish colouration of the urine.
5. Urobilinuria (*manjisthameha*): There is a pink like decoction with putrid odour of the urine.
6. Indikanuria (*iameha*): There is a bluish colouration of the urine (Purkait and Bhattacharya 2012).

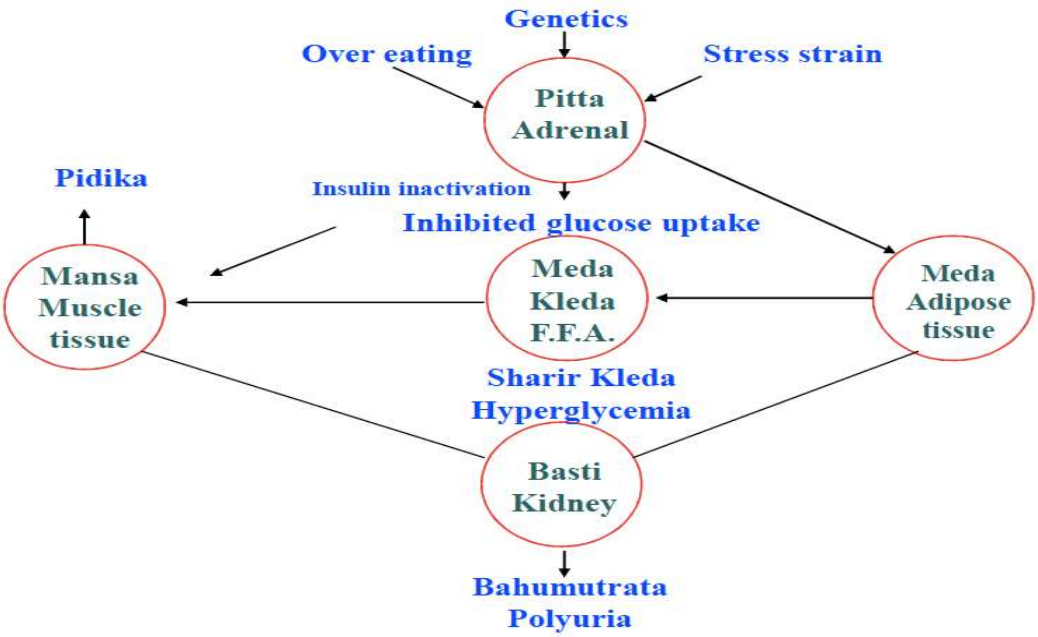


Figure 4.5. Pathogenesis of ***Pittaja Prameha*** by professor H.M. Chandola, an author of many research papers on etiology, pathogenesis and treatment of *Madhumeha.*

4.5.3.3. Diabetes complications equivalent to the *Vataja* stage of *prameha*

Due the constant decline in the two other doshas the *Vata* dosha predominates. Associated this this dosha imbalance the urine has a red or black tinge and can have pain on urination. Dietary factors that aggravate this phase of the disease are foods that are of astringent, bitter, rough, cold pungent, and easily digested. Lifestyle factors that aggravate this phase are suppression of urination or defecation, excessive sexual intercourse, physical exercise and excessive use of Ayurvedic purification procedures. Also excessive exposure to the sun and staying awake at night repetitively aggravates the disease. Psychological factors attributed to this final phase are anxiety, grief and mental trauma. There are subtypes and urinary clinical manifestations of the *Vataja* stage of the disease. Theses include:

1. DM (*madhumeha*) consists of urine that is astringent and sweet in taste, of yellowish white colour and is nonunctuous.
2. Prostatitis (*hastimeha*): The urine contains lymphatic fluid (*lasika*).
3. Albuminuria (*majjameha*): The urine contains bone marrow elements (*majja).*
4. Lipuria (*vasameha*): The urine contains fat (*Vasa*)

(Purkait and Bhattacharya 2012).

Even within *Madhumeha* which is occurring (within *Vataja* period of *Prameha*) there are also three stages: *Kapha* stage, *Pitta* and *Vata.* With every next stage the management of *Madhumeha* becomes more challenging for a physician.

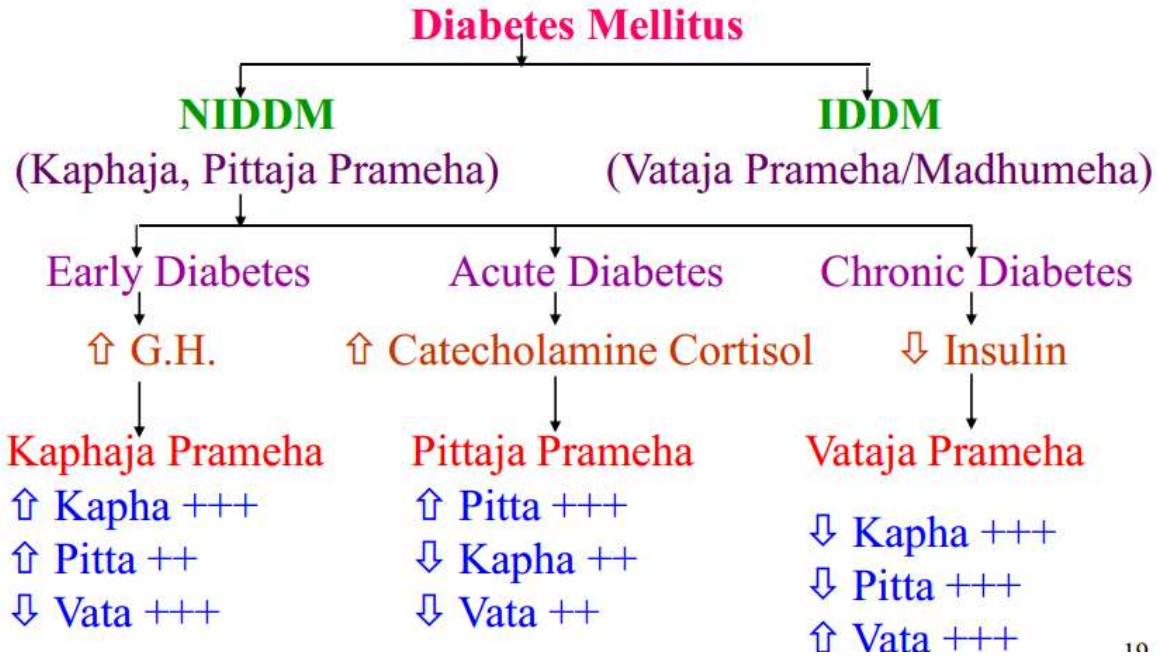


Figure 4.6. Parallel classification of *Prameha* and by professor H.M. Chandola, an author of many research papers on etiology, pathogenesis and treatment of *Madhumeha.*

4.5.3.4. Psychophysiological constitution (*Prakriti*) and *Prameha*

A patient's psychophysiological state can greatly affect the course of this disease. A positive state can greatly influence the body's response to treatment, improving the prognosis of the disease. As different stages of the disease are dominated by a different dosha, the psychological state prone to each dosha type has to be factored into the holistic treatment. Also the predominant *dosha(s)* of a patient's constitutional type can affect disease progression. It has been observed that the progression of disease is slow in diabetic patients with *Kaphaja Prakriti*, it is quick in diabetics having *Vataja Prakriti*, and moderate in the case of patients with *Pittaja Prakriti* (Chatterjee1 and Pancholi 2011).

4.5.4. Prognosis of Diabetes in Ayurveda *(Sadhya-Asadhyata)*

The ancient text of Charaka classified the prognosis of *Prameha* in three categories (Charaka samhita, Chikitsa stāna 6:57), curable, controllable and difficult to manage.

1. Curable *(sadhya):* The predominant dosha is the *Kaphaja Sthula pramehi.* Occurs during the early stage of the disease and is without complications. The typical body type is of the obese patient and the disease is acquired over time. The typical clinical manifestations are mild hyperglycemia due to disturbed carbohydrate and fatty acid metabolism and Hyperinsulinemia.

2. Controllable (*Yapya***):** The predominant dosha is the *Pittaja dosha*. It is an acquired form and can be acute and found also in young adults. The typical clinical sign is moderate hyperglycemia, due to hyperadrenalism.

3. **Difficult to manage (***Asadhya***):** The predominant dosha is the *Vataja Krisha pramehi*. This form is chronic, advanced or with complications. This stage can either be acquired in advanced stage (type 2 diabetes) and also hereditary (type 1 diabetes). The typical body type is asthenic and the typical clinical signs are severe hyperglycemia due to hypoinsulinemia (Mishra 2004) (Srinivas et al. 2014).

4.5.5. Prediabetes and Subclinical Symptoms *(purvaroopa)*

The initial symptoms occur before the disease is in its complete form. Many patients do not even realise or notice these symptoms occurring. In Ayurvedic literature the initial symptoms are:

- Polydipsia *(Trishna)*
- Glycosuria *(Madhuratva* in *mutra)*
- Polyuria *(Prabhutavilamutrata)*

- Lethargy and laziness
- Unintentional and explained weight loss
- Excessive sweating as a consequence of obesity or plain excessive sweating, which may be accompanied by body odor potentially bacterial in origin.
- Excessive waste products (*malas*) in the eyes, ears, teeth, throat, palate and on the tongue.
- Burning sensation of feet and palms and lower extremity paresthesia *(Panipada daha).*
- Excessive growth of hair and nails and matting of the hair if left unattended.
- Gingivitis and severe periodontitis due to excessive excretion of *malas* in the buccal mucosa (*Dantadinam mala sanchaya).*
- Sweet taste in the mouth *(Svadasyata)* due to glucose in the saliva, which can increase the risk of oral candidiasis.
- Attraction of insects and ants toward the body and urine.

(Mehmood et al. 2011) (Challem and Hunninghake 2007)

4.5.6. Obesity in Ayurvedic texts and it's relation to *Prameha (Sthaulya)*

One factor contributing to obesity is the thought that it often is the result of feeling unloved or uncared for; fat acts as a psychological barrier or protection instead. In excess it also leads to fatigue, asthma, sexual debility, extreme thirst, hypertension, diabetes, sagging breasts, belly and thighs and lack of mobility (Hussain et al. 2010). Emotionally it will lead to greed and attachment. On the contrary balanced fat tissue creates ideal body weight, mild oiliness of skin, hair and muscles, a melodious voice, joy, humour and a loving, affectionate nature. In modern medicine standard fat distribution tables take into account only age, height and weight. According to Ayurveda there is more information that is important particularly the constitution of person as *Vata, Pitta* and *Kapha* individuals will differ at the same age, height and weight. Obesity occurs as a result of an inactive, sedentary lifestyle combined with an excessive intake of food stuffs in proportion to energy expenditure (Feinglos and Bethel 2008). According to Ayurveda when this occurs toxins are formed from improperly digested food and metabolic products leadings to the additional formation of fat. Common sequelae of increased weight is hyperinsulinemia and insulin resistance (Gordon et al. 2013). Upon correcting lifestyle and dietary change, insulin dysfunction can resolve. In particular it is the intraabdominal fat that is associated with insulin resistance. When the male sex increases in weight it commonly occurs in this area moreso than others, increasing the possibility of insulin resistance. The relationship between obesity and *prameha* in Ayurvedic texts has firmly been established. The role of adipose tissue is of great importance in the pathogenesis

of *prameha* due to the distruption of *dhatus*. The ancient writing of Charaka Samhita explains that *Kapha* states contribute to having too much bodily liquids and it affects the fat tissues. It causes it to become viscous in nature and this form of *meda* has been described as acting on muscle tissue, thereby increasing the volume of body fluid. Excess fluid in the blood causes increased diuresis and is excreted into the urine. This relationship ties the bond between excess adipose tissue and the pathogenesis of diabetes. (Challem and Hunninghake 2007)

4.5.7. Complications (*Upadravas*)

Diabetes is well known for its array of disease complications:

- **Diabetic retinopathy**: This complication is a leading cause of blindness and visual disability and it is caused damage to the small blood vessels in the retina. Findings consistent from study to study, make it possible to suggest that, after 15 years of poorly controlled diabetes, approximately 2% of people become blind, while about 10% develop severe visual handicap. With proper control loss of vision and blindness in persons with diabetes can be prevented.
- **Diabetic Nephropathy:** This complication is characterised during the later stages of the disease by increased proteinuria, arterial hypertension and chronic renal disease. Increased lipotoxicity, including increased synthesis of fatty acids, sphingolipids and phospholipids contribute to the development of these complications and it is a major contributor to increased cardiovascular disease risk (Leslie et al 2012).
- **Diabetic Heart disease:** This complication accounts for approximately 50% of all deaths among people with diabetes in industrialised countries. There are multiple risk factors for heart disease including smoking, high blood pressure, high serum cholesterol and obesity. A combination of macrovascular and microvascular pathologies are thought to contribute to damage of the large and small bloods vessels primarily atherosclerotic in origin (Holt and Kumar 2010).
- **Diabetic neuropathy** is a common and a serious complication characterised by progressive loss and damage of peripheral nerve axons resulting in decreased sensation and a reciprocal increase in pain. Decreased blood flow due to microvascular disease combined with hyperglycaemia contributes to the pathogenesis of this complication. Approximately 60%–70% of patients have some form of neuropathy, with risk increasing with age and duration of disease. Clinical diagnosis of diabetic neuropathy is usually associated with significant and often irreversible nerve damage (Leslie et al 2012).

- **Diabetic foot disease**: This complication often leads to ulceration and subsequent limb amputation due to changes in blood vessels and nerves. Diabetes is the most common cause of non-traumatic amputation of the lower limb, which may be prevented by controlled treatment, regular inspection and good care of the foot (Ali 2011).

  According to Auyrvedic literature complications of diabetes consists of:

  - Obesity (*Sthaulya*)
  - Diabetic carbuncles (*Prameha Pidaka*)
  - Nephropathy/urinary disorders (*Mutrakricchra*)
  - Skin diseases (*Kustha*)
  - Erectile dysfunction (*Klaibya*)
  - Generalized edema (*Sopha*)
  - Structural and functional impairment of the sensory organs (*Indriya Srotasam Lepa*)

  (Purkait and Bhattacharya 2012)

  Furthermore each dosha type has characteristic complications that are more specific for each. A classification of *Madhumeha* has been given in such classical Ayurvedic text as *Madhava nidana* chapter 34 (verses 18 - 20):

  Vata complications:

  - Spasm *(Stambha)*
  - Reverse peristalsis *(Udavarta)*
  - Tremors *(Kampa)*
  - Sudden or gradual loss of weight *(Shosha)*
  - Constipation *(Baddha puresha)*
  - Chest compression and pain *(Hritgraha)*
  - Cough *(Kasa)*
  - Insomnia *(Anidra)*
  - Difficulty to breath *(Shwasa)*
  - Nonspecific pain *(Shula)*
  - Polyphagia or Longing for sweet taste *(Loulyam)*

  Pitta complications:

  - Diarrhea *(Atisara)*
  - Anemia *(Panduroga)*
  - Distaste *(Arochaka)*
  - Burning sensation (*Daha)*
  - Hyperacidity *(Amlika)*
  - Pain in penile region *(Metratoda)*
  - Pain in chest *(Hrithshoola)*
  - Vertigo or syncope *(Murccha)*

- Vomiting *(Vamana)*
- Hot flushes *(Paridhumayana)*
- Fever *(Jvara)*
- Thirst *(Pipasa)*
- Inflammation and pain in bladder and urinary tract *(Vrishanayoravdarnam)*
- Yellowish discoloration of stool, urine and conjunctiva (*Pitavitmutra netra)*

Kapha complications:

- Frequent Rhinitis *(Pinasa)*
- Nausea *(Cchardi)*
- Frequent Cough *(Kasa)*
- Loss of appetite *(Aruchi)*
- Fatigue (*Alasyam*)
- Frequented by flies (*Mashikapsarpana*)
- Excessive sleep *(Ati Nidra)*
- Indigestion *(Avipaka)*
- Weight Gain (*Mamsopachaya)*
- Breathlessness (*Shvasa)*

4.5.8. Main aspects of pathogenesis and complications in particular of *madhumeha* according to Ayurvedic classics

Madhumeha, a subtype of *Vata prameha,* is equivalent to type 2 diabetes but other *Prameha* disorders involve various endocrinal, metabolic and inflammatory diseases. *Sanchaya, Prakopa, Prasara Sthanasamshraya, Vyakta* and *Bheda* are the six stages in the development of the disease identified in the *Sushruta*. The first three stages are often are unrecognised as these symptoms are mild enough for the patient to think all is under the norm. Unfortunately, these are the stages that are reversible if identified and treated which highlights the importance in early diagnosis and treatment. Diabetes type 2 (*Madhumeha*) is correlated into these six stages:

- First stage *(Sanchaya Avastha)*: *Madhumeha Kapha dosha* is aggravated in the upper gastrointestinal tract. These are prodromal and early symptoms of Diabetes type 2 and presents itself with the following symptoms:

a) A feeling of lethargy, laziness and dullness.

b) There is a reduced metabolic capacity or indigestion.

c) The body feels a sense of heaviness.

- Second stage (*Prakopa Avastha)*: *Kapha* predominates leading to metabolic impairment and overload due to persistent untreated etiological factors. Prediabetic stage of altered glucose tolerance is present with mild insulin secretion insufficiency of the pancreas.
- Third stage (*Prasara Avastha)*: Due to *Kapha* dominance toxins and improperly transformed metabolites cause disease progression. There is metabolic imbalance in extra-

pancreatic sites, for example, insulin resistance in the peripheral tissues and insulin deficiency in the gastrointestinal tract. Due to these secondary sites of *Madhumeha,* symptoms can be:

a) Intense fatigue (*Angasada)*.

b) Eversion to food (*Annadvesha)*.

c) Early satiety (*Arochaka)*.

d) Impaired tissue metabolism with indigestion of the gastrointestinal tract (*Avipaka)*.

e) Fullness/heaviness of the epigastric and/or chest region (*Hridayotklesha)*.

- Fourth stage *(Sthana Samshraya Avastha)*: The disease at this stage has progressed to both primary and secondary sites due to the dosha imbalance, thus insulin secretion insufficiency and altered glucose tolerance.
- Fifth stage (*Vyakta Avastha)*: The typical clinical symptoms and signs become obvious at this stage such as polyuria, polydipsia and polyphagia. The clinical picture of diabetes mellitus type two is present equivalent to that of *Madhumeha.* Included in this stage are other etiological causes such as autoimmune and inherited type one diabetes. If appropriate treatment is implemented during this stage, before end organ damage has occurred, then the disease can be managed efficiently. On the contrary if this stage is not managed appropriately then permanent and incurable (*Yapya)* damage will occur.
- Sixth stage (*Bheda Avastha)*: End organ damage is permanent and chronic complications have occurred. The complications can be one or more of the variety of retinopathy, neuropathy, nephropathy, diabetic foot ulcers and secondary complications such as infections and cardiovascular complications. The prognosis at this stage of the disease is poor.

4.5.9. Treatments *(Chikitsa)*

In the holistic approach there are multiple layers to be implemented in the treatment of diabetes type two. This includes addressing the psychophysiological constitution of the patient and the specific etiopathology. These have been written about in-depth in the ancient writings of Ayurveda such as in Chikitsa sthāna 6th chapter and Prameha Nidana chapter 33. An important factor is to avoid the etiological causes and to reverse the progression of the pathophysiologic process. Different treatment forms are more successful at certain stages, thus determining a patient's stage of disease is paramount to successful treatment. For example bio purification (*Samshodhana*), which can be aggressive on the body is the best option for physically strong patients with type two diabetes. After this treatment, techniques to pacify the

doshas (*Samshamana*) can be used. On the contrary weak patients require treatments that only pacify the *doshas* as bio purification can be too aggressive (Loon 2003). As obesity is a prevalent etiological factor in the development of type two diabetes, implementing a balanced nutrition plan with restricted calories (*Apatarpana*), doing regular physical exercise and using herbal supplements all combined can reverse early *Prameha*. Depending on the stage of the disease and which *dosha* predominates, different dietary regimes can be used, tailored at correcting the *dosha* imbalances. For example *Kaphaja Prameha* patients need more catabolic diet and *Vataja Prameha* patients need a diet that is more anabolic (Purkait and Bhattacharya 2012).

4.5.9.1. Dietary management

There is and old Ayurvedic proverb which emphasizes the importance of proper diet: "When the diet is wrong, medicines are of no use. When the diet is right, there is no need for medicines". Unbeknown to much of the general public food consists of more than just carbohydrates, proteins, fats fibres and standard vitamins. Ayurvedic herbs prove that there are more to foods than these main ingredients and these 'unknown nutrients' Ayurveda utilises to influence a person's health. A balanced diet containing the right portion of carbohydrates, proteins, fats, fibres, minerals and vitamins creates a healthy internal environment (Mccullock 2008). For successful management of type 2 diabetes, a patient must eat a controlled diet consisting of foods that are not sweet, not too oily, have the ability to mitigate *Kapha* and *Meda* while being nourishing. Recommended is a warm diet (*Ushna*) as it eases *Kapha*, normalises *Vata* and stimulates *Pitta* to increase digestion. Foods that are rich in b-glucan improves glucose tolerance, reduces insulin responses and lowers inflammatory markers. Barley is rich in b-glucan and can make an important part of a balanced diet. For the purpose of mitigating Prameha the preparation in barley consists of soaking barley overnight in a decoction of *Triphala*. *Triphala* is a herbal mixture comprised of *Phyllanthus emblica, Terminalia bellirica* and *Terminalia chebula*. Other herbs that express antidiabetic properties can also be used such as turmeric, coriander, cumin and cinnamon. Dr. Paritosh Bhatt from Arya Vaidya Chikitsalayam Research center provides this table about the recommended foods (*Pathya Ahara*) and unrecommended food substances (*Apathya Ahara*):

Table 4.18. Recommended foods (*Pathya Ahara*) unrecommended food substances (*Apathya Ahara*).

PATHYA AHARA		***APATHYA AHARA***	
English/or Sanskrit	**Latin**	**English/or Sanskrit**	**Latin**
Fox tail millet	*Serratia italica*	Potato	*Solinum tuberosam*
Barley	*Hordeum valgare*	Sweet Potato	*Ipomoea batatas*
Kodo millet (rice grass)	*Paspalium scrobiculatum*	Tapioka/ Cassava root	*Manihot esculenta*
Little millet	*Paniculam sumatrense*	Red Radish	*Raphanus sativus*
Godhuma	*Tritium aestivum L.*	White radish	*Raphanus sativus*
Red rice	*Orizan sativa L.*	Beetroot	*Beta vulgaris*
Sesame	*Seasame orientia L.*	Turnip	*Brassica rapa*
Corn	*Zea mays L.*	Chayole	*Sechium edule*
Horse gram	*Macrotyloma uniflorum*	Sugar cane	*Saccharum officinarum*
Green gram	*Phaseolus radiatus*	Freshly harvested rice	*Oriza sativa*
Chick pea/Bengal gram	*Cicer arietinum*	Curd/Fat yogurt	
Tuvar dal	*Cajanus indicus*	Red meat	
Honey (in moderate quantities)	*Mel mellis*	Fish	
Butter milk		Jaggery (uncentrifuged sugar from dates, palm, cane)	*Saccharum officinarum*
Coconut oil			
Drum stick	*Moringa olifera L.*		
Bottle gourd	*Lagenaria siceraria*		

Bitter gourd	*Momordica charantia*		
Ridge gourd	*Luffa acutangula*		
Broud bean	*Vica faba Linn.*		
Curry leaves	*Murraya koenigii*		
Cucumber	*Cucumis sativus*		
Unripe banana	*Musa paradisiace*		
Garlic	*Allium sativa*		
Ficus fruit	*Ficus hipsida*		
Dates	*Phenix dactylifera*		
Common guava	*Psidium guajava*		
Gooseberry/Amalaki	*Emblica officinalis*		
Chebulic Myrobalan/Haritaki	*Terminalia chebula*		
Beleric myrobalan/Vibitaki	*Terminalia belarica*		
Black pepper	*Piper nigram*		
Dry ginger	*Zingiber officinalae*		

(Lad 1984)

4.5.9.2. Lifestyle

The lifestyle of an individual includes the habits, attitutes, tastes, moral standards, economic level, etc., that together constitute the mode of living of an individual or group. A healthy lifestyle is about having healthy habits and once a habit is developed which can be challenging to upkeep, the implementation of the habit becomes easy and natural. A healthy habit can include meditating and is said to be a necessary practice in achieving health, balance, and fulfilment as a result of integrating mind-body and soul, which according to Ayurveda, is the real definition of health. Contrary to western medicine concepts, Ayurveda teaches that every body has a different mind-body constitution. By adapting your habits to your *dosha* type, you gain vitality and wellbeing. Having the correct amount of sleep is very important for your body's balance. A person feels better rested, less tired, able to concentrate more and is fresher. It is also beneficial to avoid anything that upsets the senses, for example to avoid TV shows that generate stress such as the news or violent shows. Some people do daily self-massage in

their morning routine and feel that it improves circulation, nourishes the skin and awakens the body's inner pharmacy. Also beneficial is aromatherapy as the sense of smell is very powerful and relates directly to memories and emotions in your brain and can calm your mind or improve your health and concentration (Ali 2011).

4.5.9.3. Yoga practices

Yoga has recently been found to have beneficial effects on blood glucose levels in individuals with diabetes and other chronic health conditions (Ross and Thomas 2010). In a blinded, randomized controlled trial involving 186 type 2 diabetics, Gordon et al. (2008) compared the effects of 6 months of weekly classes plus home practice of yoga with aerobic exercise plus stretching. Compared to baseline measures and a control group, both yoga and exercise led to significant reductions at 3 and 6 months in fasting blood glucose (29.48% and 27.43%, respectively, $p<0.0001$).33 Both the exercise and yoga groups exhibited improvements in serum total cholesterol ($p<0.0001$), and very low density lipoprotein ($p¼0.036$) compared with controls. Also included in the benefit are the mental health benefits including improvements in the quality of life, depression, stress, anxiety, quality of sleep, self-esteem, and overall psychological well-being.

As diabetes is a progressive disease over many stages there are modifications that have to change in the yoga regime depending on the stage of disease. The pre diabetic stage of disease and the condition of a patient is very different from the late stage disease with end organ failure. According to Ayurveda there are different types of postures recommended for the beginning stages of *Madhumeha* (in *Kapha* phase). This is because there is a greater need in this stage to do more active physical exercise. During the *Vata* stage there is a different regime as a patient regularly feels weak and ill. In the majority of patients who use Yoga and exercise regularly find that at a minimum, their quality of life improves because blood circulation improves thus reducing harmful reactive oxygen species (Tirtha 2005). This was proven in a study by H.H. Mahapure et al. on the effect of yogic exercise on super oxidase dismutase levels in diabetics. The results revealed that yogic exercise enhanced the levels of superoxide dismutase and reduced glycosylated Hb and glucose levels in the experimental group as compared to the control group In the classics of yoga shastra (ancient texts of yoga) the author Swami Satyananda Saraswati wrote Asana Pranayama Mudra Bandha that gives clear guidelines which yoga postures and breathing techniques are best for the patients of diabetes.

As stated the different phases of the disease require different Yoga poses:

In ***Kapha*** phase patients have the highest body mass index and most physical strength, the recommended regiment is as follows:

Table 4.19 ***Kapha*** Phase:

Yoga Pose	***Sanskrit Name***
Sun Salutation	*Soorya Namaskaram*
Shoulder standing pose	*Sarvangasanam*
Plough pose	*Halasanam*
Bow pose	*Dhanurasanam*
Diamond Pose	*Vajrasanam*
Baby Pose	*Sasankasanam*
Half Spinal twisting pose	*Ardhamatsyendrasanam*
Skull illuminating practice	*Kapala bhaati*

(King 2015) (Hope-Murray 2013) (Cavanagh et al. 2004)

Table 4.20 ***Pitta*** phase the recommended yoga postures are:

Yoga Pose	***Sanskrit Name***
Fish pose	*Matsyasanam*
Cobra pose	*Bhujangasanam*
Forward bending pose	*Paschimottanasanam*
Diamond pose	*Vajrasanam*
Baby pose	*Sasankasanam*
Hands to feet pose	*Padahastasanam*
Alternate nostril breathing practice	*Nadi suddhi*

(King 2015) (Hope-Murray 2013) (Cavanagh et al. 2004)

Table 4.21: In ***Vata*** phase the disease progression is advanced so a patient may find the physical demands of yoga and exercise in general difficult. Where possible though to do exercise it is still regarded that small amounts of exercise can improve a patients state of mind and physical well being.

Yoga Pose	***Sanskrit Name***
Divine pose	*Siddhasanam*
Air expulsion pose	*Pavanamuktasanam*
Half locust pose	*Ardha Salabhasanam*
Diamond pose	*Vajrasanam*
Baby pose	*Sasankasanam*
Alternate nostril breathing practice	*Nadi suddhi*

(King 2015) (Hope-Murray 2013) (Cavanagh et al. 2004)

4.5.10. Ayurvedic medicines for *Madhumeha*

It is known that diabetes type two in the greater majority of its forms is a secondary disease occurring as a result of a different disease process. According to Ayurveda literature by treating any disease, firstly you should lay the foundation for healing by correcting the *dosha* imbalance. Correcting the *dosha* imbalance already can improve the symptoms and allow direct treatment of *prameha* to begin resulting in the reversal of disease process. Diseases that can cause diabetes mellitus type two as a secondary disease can include inflammatory bowel syndrome, piles, obesity, toxic, alcoholism, bacterial and viral infections, thyroid disorders and drug induced or poisoning. This highlight the importance of the Ayurvedic physician as it is their role to treat these disorders at the same time as treating diabetes mellitus type two. According to *Charaka* one of the Ayurvedic principles for diagnosis and treatment is that "an existent disease is expressed as a syndrome along with varies pre-existing disorders, complications of those disorders as well as complications of disease, *prameha* itself ". This principle is known as *vyadi shanka ratva* and implies that treatment has to be devised not only on the basis the *dosha* predominance or stage of the disease but also it should inevitably consider the co-morbidities as well. Before treatment begins there certain details that must be attained to determine the best treatment course, these are:

- Phenotypic expression of genotype *(Prakriti)*.
- Age of the patient *(Vaya)*.
- Pathological state *(Vikriti)*.
- Exercise tolerance *(Vyayama Shakti)*.

- Psychological wellbeing *(Satva)*.
- Geographic, ethnic, climatic, diet adaptability *(Satmya)*.
- Tissue and organ vitality *(Sara)*.
- Physical buildup *(Samhanana)*.
- Digestive or metabolic efficiency *(Ahara sakthi)*.
- Body dimensions and mass *(Pramana)*.

Table 4.22: According to Ayurvedic classics co-morbidities found to be associated with diabetes.

Disease or condition in modern medicine	**Sanskrit term**
Skin diseases	*Kustha*
Diabetic carbuncles	*Prameha pidaka*
Degenerative disorders of the bones, bone marrow and joints	*Prabala sameera sandhi asthi majjagata*
Tubular ulcers	*Nadi vrana*
Heart diseases	*Hridroga*
Eye diseases	*Netra gada*
Anaemia	*Pandu*
Oedema	*Sopha*
Cancer	*Arbuda*
Cough, dyspnea and rhinitis	*Kasa, Svasa and Pīnasa*
Abscess	*Vidradhi*
Fistula	*Bhagandara*
Rheumatoid arthritis	*Vata rakta*
Neurological disorders	*Vatavyadhi*
Splenic disorders	*Plīha Roga*
Abdominal enlargement	*Udara*
Urinary complaints	*Mūtrakricchra*

Infertility	*Vandhyatvam*
Psychiatric disorders	*Unmada*
Bleeding disorders causing pain	*Asrgdhara ruja*

(Holt and Kumar 2010) (Ali 2011)

Table 4.23: According to the particular disease phase there are particular multi herbal remedies that are used in Ayurveda. The basic principles of medicinal forms are:

Madhumeha Phase	**Medicinal Form**
Kapha	Crude medicine powder (*Choornam*), a decoction of water extracts or aquasomes (*Kayasha)* and processed powders compressed into pills (*Vati*).
Pitta	*Kapha* medicinal forms and in addition liposome form (*Ghee*).
Vata	*Kapha* and *Pitta* medicinal forms and in addition oil in liposome form (*Tailam*) and processed alcoholic extracts (*Arishtam*).

In the *Vata* stage of the disease, all doshas are out of balance thus a herbal decoction of twenty-nine herbs (*guggulu tikta kashayam)* are given in alcoholic liquid (*arishtam*) or oil (*tailam*) form (Government of India 2007). On the contrary in the early stage of the disease it is given in the *kashaya* form and in the *Pitta* stage it is administered as medicated clarified butter form *(Ghee)*. These twenty-nine decoctions of herbs are not only administered to treat the diabetes but also to treat comorbid conditions such as has chronic skin diseases, chronic sinusitis, fistulas or chronic ulcers (Ayurvedadosha 2015).

Other forms of treatment by herbs can include *Kalyanakam gana* which is used for patients with the symptoms or complications of various neurological conditions like epilepsy, convulsions, illusions/ hallucinations and loss of memory. It is also used for dyspepsia, chronic anemia, chronic fever and edema. Another treatment option is *Aragvadhadi gana* being administered in the form of *kashaya* or *arishtam.* It is given to *Kapha* disorder patients and in patients with nausea, vomiting, chronic ulcers or with pruritus. The powder form of *Amruthadi Choornam* is effective and recommended for almost any stage of diabetes and are given along with other medicines. Small pills known as *Chandra Prabha vati* are administered when the diabetes is advanced with complications. Common uses of this type are with

complications such as cough, asthma, anemia, jaundice, dysuria, renal or gall bladder stones, cysts, tumors, inguinal hernia, dental disorders, semen disorders, menstrual disorders skin diseases, hemorrhoids, spleenomegaly and fistulas (Ayurvedadosha 2015).

Unfortunately even in India the cost of medicine can be too expensive for many people and due to this, single herb therapy is quite common. Also like standard drugs there are potential side effects of long term herbal therapies thus single herbal therapy might be considered by the Ayurvedic physician. There is a wide variety of literature available on the effects of single and multiple drug therapy. This however is only one part of the holistic approach Ayurveda represents and there is a need for future studies into combined lifestyle, diet, medication and exercise/yoga implementation in diabetes type two sufferers. An issue that Ayurvedic studies face is that the variety of techniques used by Ayurvedic physicians differ under the same patient circumstances and also the multifactorial variations of patient factors (*prakriti* and *vikriti)* and treatments combined that a standardized research design is difficult to implement. Venu Gopal Jonnalagadd and Nilakash Selkar compiled a current list of single and multiple herbal therapies that are now used in India entitled “Antidiabetic Herbal Products Marketed in India: An Update” as seen in table 4.24:

Table 4.24 Antidiabetic Herbal Products Marketed in India

S.No	Brandname	Manufacturer	Ingredients
1	Diabecon	Himalaya	*Balsamodendron mukul, Pterocarpus marsupium, Casearia esculenta, Gymnema sylvestre, Glycyrrhiza glabra, Tinospora cordifolia, Swertia chirata, Tribulus terrestris, Phyllanthus amarus, Gmelina arborea, Berberis aristata, Aloe vera, Eugenia jambolana, Asparagus racemosus, Boerhaavia diffusa, Sphaeranthus indicus, Gossypium herbaceum, Shilajeet and powders of Momordica charantia, Piper nigrum, Ocimum sanctum, Abutilon indicum, Curcuma longa, Rumex maritimus and Trikatu.*
2	. Pancreatic tonic 180 cp	Ayurvedic herbal supplement	*Pterocarpus marsupium, Cinnamomum tamala, Gymnema sylvestre, Azadirachta indica, Ficus racemosa, Aegle marmelos, Trigonella foenum graceum, Momordica charantia, Syzygium cumini*
3	Diasulin		*Cassia auriculata, Coccinia indica, Momordica charantia, Syzygium cumini, Emblica officinalis, Trigonella foenum graecum, Curcuma longa, Gymnema sylvestre, Tinospora cordifolia, Scoparia dulcis*
4	Bitter gourd Powder	Garry and Sun natural Remedies	Bitter gourd (*Momordica charantia*)
5	Diabetes-Daily Care	Nature's Health Supply	Alpha Lipoic Acid, Chromax, Vanadium, Cinnamon Extract, Fenugreek extract, *Gymnema sylvestre* extract, *Momordica* extract, Licorice Root extract
6	Ayurveda alternative herbal formula to Diabetes:	Chakrapani Ayurveda	Gurmar (*Gymnema sylvestre*), Jamun Gutli (*Syzygium cumini*), Neem (*Azadirachta indica*), Methika (*Trigonella foenum gracecum*), Guduchi (*Tinospora cordifolia*), Pushkarmool (*Inula racemosa*) , Karela (*Momordica charantia*).
7	Dia-care	Admark Herbals Limited	Sanjeevan Mool, Jambu beej, Kadu, Neem chal, Himej, Namejav
8	Gurmar powder	Garry and Sun natural Remedies	Gurmar (*Gymnema sylvestre*)
9	Syndrex	Plethico Laboratories	Germinated Fenugreek seed extract
10	Diabecure	Nature beaute sante	*Berberis vulgaris*, Millefolium, *Juglans regia, Erytherea centaurium*, Taraxacum
11	Epinsulin	Swastik Formulations	vijaysar (*Pterocarpus marsupium*)
12	. Diabeta	Ayurvedic cure Ayurvedic Herbal Health Products	*Momordica charantia* (Bitter Gourd), *Zingiber officinale* (Ginger), *Gymnema sylvestre*, *Curcuma longa* (Turmeric), *Pterocarpus marsupium* (Kino Tree), *Vinca rosea* (Periwinkle), *Azadirachta indica* (Neem), *Tinospora cordifolia*, *Acacia arabica* (Black Babhul), *Syzygium cumini* (Black Plum).
13	Madhumeha Kusumakara Rasa	Shree Dhoothapapeshwar Limited	Vasant Kusumakar Rasa (Suvarnayukta), Mamajjaka ghana (Dried Aq. extract of *Enicostemma littorale*), Haridra (*Curcuma longa*), Amalaki *(Emblica officinalis*), Shuddha Shilajatu (Processed asphaltum), Guduchi (*Tinospora cordifolia*), Yashada bhasma (*Zinc bhasma*), Bilva patra swaras (*Aegle marmelos),* Asana kwath (*Pterocarpus marsupium*).
14	Zpter	Om Pharmaceuticals Limited	Vijayasara, Dalchini, Haridra, Haritaki, Bibhitaki, Amalaki, Chtrak , Jasad Bhasma,Guduchi (*Tinospora cordifolia*) and Madhunashini (*Gymnema sylvestre*).
15	HypoNIDD	Charak Pharma	Yashad Bhasma (Zinc Calx), Shilajit (Purified Asphaltum), Karela (*Momordica charantia*, bitter gourd), Haridra (*Curcuma longa*, turmeric), Tarwar (*Cassia auriculata,* Avarakkai, Indian broad-beans), Amalaki (Amla, Indian Gooseberry, *Emblica officinalis*), Raja Jambu (*Eugenia jambolana*), Mamejavo (*Enicostemma littorale*), Meshashringi (*Gymnema sylvestre*), Vijaysaar (*Pterocarpus marsupium*), Guduchi (*Tinospora cordifolia*), Neem (*Melia azadirachta*), Kirat Tikta (*Swertia chirata*)
16	Dabur Madhu Rakshak	Dabur	Amla (*phyllanthus emblica*), Tejpatra (*Cinnamomum tamala*), Vijaysar (*Pterocarpus marsupium*), Gurmar (*Gymnema sylvestre*), Jamun seed (*Eugenia jambolana*), Kali marich (*piper nigrum*), Neem leaves (*azadiracheta indiaca*), Methi (*trigonella foenum-graecum*), Bahera (*Terminalia belerica*), Bhavana Dravyas, Shudh Shilajit, karela fruit (*momordica charantia*), Hareetaki (*Terminalia chebula*)
17	Ojamin	Tates remedies	*Aegle Marmelos, Trigonella Foenum Graecum, Carum Carvi, Emblica Offcinails, Terminalia Chebula, Terminalia Belarica, Swertia Chirata, Tinospora Cordifolia, Eugenia Jambolana, Picrorhiza Kurroa, Gymnema Sylvestre, Salacia Chinensis* Linn, *Curcuma Longa, Melia Azadirachta*
18	Madhumehari Granules	Baidyanath	gudmar (*gymnema sylvestre*), Jamun guthali (*syzygium cumini*), Gulvel (*Tinospora cordifolia*), Kkarela Beej (*Momordica charantia*), Khadir Chuma (*Acacla Catechu*), Haldi (*Curcuma Longa*), Amia (*Emblica-officinalis*), vijay-sar (*Pterocarpus Marsupium*), Tejpatra (*cinnamomum-Tamala*), Shilajit (Asphaltum), Gularphal Chuma (*Ficus Glomerata*), Kutki (*Picrorhiza Kurroa*), Chitrak (*plumbago Zeylanica*) , Methi (*Trigonella-foenum graecum*), Bhavna of Neem Patti (*Azadirachta - Indica*), Bilwa Patra (*Aegle Marmelos*)

4.6 INSITES OF THE LITERATURE REVIEW

After extensive research into Ayurvedic literature whether texts that are thousands of years old or recent medical journal articles, it is evident that there is a wealth of knowledge and understanding of into the complexity of human health. As human society advances into urbanisaiton, mainstream diets and sedentary lifestyles Diabetes is growing into a major world health problem. This identifies that for countries worldwide, government budjets will have to increases to manage the diabetes crisis and Ayurverdic treatment can play a role in helping this crisis not only to save money but holistcally improve the lifestyle of their populations. Though there are many research articles into Ayurvedic herbs and their pharmalogical effects, none have yet combined conventional diabetic medicines and Avurvedic medications together to study their relationship with Fasting Blood Glucose, Hba_{1c} and Body Mass Index. Not only this, there are no articles that separate *Prakriti* and *Vikriti* subgroups diagnostically to identify if there is benefit into the individualised Ayurvedic approach then the imperical conventional approach. In the following research study I have conducted a never done before pilot study to identify if under the current collected data is there any statistical significance between conventional diabetic treatment verse combined Ayurvedic and conventional treatments and also if there is statistical significance between between and inbetween *Prakriti* and *Vikriti* subgroups.

5. MATERIALS AND METHODS

Design:

Randomised two armed placebo control prospective cohort study.

Duration: 3 months

Study Centre:

Single centre Study at the Arya Vaidya Chikitsalayam and Research Institute, Trichy road, Ramanathpuram, Coimbatore. Tamil Nadu, India.

Number subjects: 32 subjects in total, 21 subjects in 1st arm and 11 in 2nd arm.

1st arm: Patients use Ayurveda medication in combination with conventional treatment.

2nd arm: Patients use placebo medication in combination with conventional treatment.

Inclusion criteria:

- Patients with type 2 diabetes.
- Fasting blood glucose >6.66 mmol/L (>120mg/dL) with no calorie intake within 8hrs pre-test.
- 2hrs plasma glucose >11.1 mmol/L (>200mg/dL) using the Oral Glucose Tolerance Test.
- The tests are performed according to the WHO recommendations of glucose load containing equivalent of 75g of anhydrous glucose dissolved in water. This is given to patients with classical symptoms of hyperglycemia or glycemic crisis and random plasma glucose more than 11.1 mmol/L (200 mg/dL).
- Patients that have type 2 diabetes with greater than 7g Hba_{1c} but less than 9.5g.
- Patients who are aged between 25-65yrs who are willing to give informed consent.

Exclusion criteria:

- All type 1 Diabetes Mellitus patients.
- Any pregnant patients.
- Patients with renal failure.
- Patients who have recently had a stroke or who have unstable angina.
- Patients who have severe diabetic complications
- Patients with severe infections and/or inflammatory conditions.

5.1 STUDY DESIGN

Methods

The study was carried out over a period of three months at the Arya Vaidya Chikitsalayam and Research Institute. The study protocol was approved by an institutional ethical committee and samples were screened after obtaining informed consent from all the participants. The screening included the history of health status and also for the inclusion and exclusion criteria as mentioned. Each subject was interviewed with the standard questionnaire as mentioned by Prasher et al. 2008 and the information was fed in Ayusoft Prakriti software by trained Ayurvedic physicians. The interview lasted for approximately 45minutes each. The assessment parametric for *Prakriti* was based on three primary Ayurvedic texts, *Charaka Samhita, Ashtanga Hridayam and Ashtanga* and the *Sushruta Samhita*. The traditional Ayurvedic method of Prakriti determination involves a wide range of methods employed by Ayurvedic physicians through physical examination, which involves visual, tactile, olfactory and auditory assessment. Inference based on information collected by indirect means including asking questions and conclusions drawn based on available data knowledge and experience. The parameters include visual assessment of morphological features such as skin colour, hair colour and consistency, soft tissue to bony tissue proportions, tactile feature such as dryness oiliness of skin and body temperature. Analytic features such as radial pulse (*nadi*): interrogative subjective physical findings such as physical strength, endurance, appetite, sleep, bowel habits, subjective intellectual and emotional attributes such as memory retention and anger response, restlessness and composure. Final conclusion is drawn by the Ayurvedic physician on the entire range of parameters coupled with direct interaction with the subject. Assessment of *Prikriti* is performed by Ayusoft software that was purchased from Centre for Development of Advanced Computing (C-DAC), Pune, Department of Information Technology, Ministry of Communications and Information Technology (MCIT), India. *Prakriti* assessment by AyuSoft was performed using weight age configuration. There are 85 questions related to the anatomy, physiology, and psychology. “Weight age” ranging from 1 to 10 is provided for every question to predict the *dosha* (manifestation of each trait in a given *Prakriti*). Traits related to physical or anatomical features have been assigned higher weight age cut-off as it remains stable throughout the life. In contrast, physiological and psychological factors vary with respect to the habitat and hence lesser weight age was assigned. The *Prakriti* can be determined for all age groups and the weight age configuration can be modulated accordingly within the software by clinicians and thus aids in the assessment of *Prakriti*. All questionnaires define the character of the dosha dominance and

report cumulative dominance in percentage within anatomical, physiological and psychological parameters (www.ayusoft.cdac.in). The Ayurvedic physician who carried out AyuSoft interview was a qualified Ayurvedic physician (BAMS graduate) with a minimum of 2 years of experience. Height was measured to the nearest 0.1 cm using wall-mounted stadiometer by asking the subjects to stand straight without footwear. Weight was measured with minimum clothes using a calibrated electronic scale to the nearest 0.1 kg. Height and weight of individuals was measured by the junior ayurvedic physician who was also operating the AyuSoft.

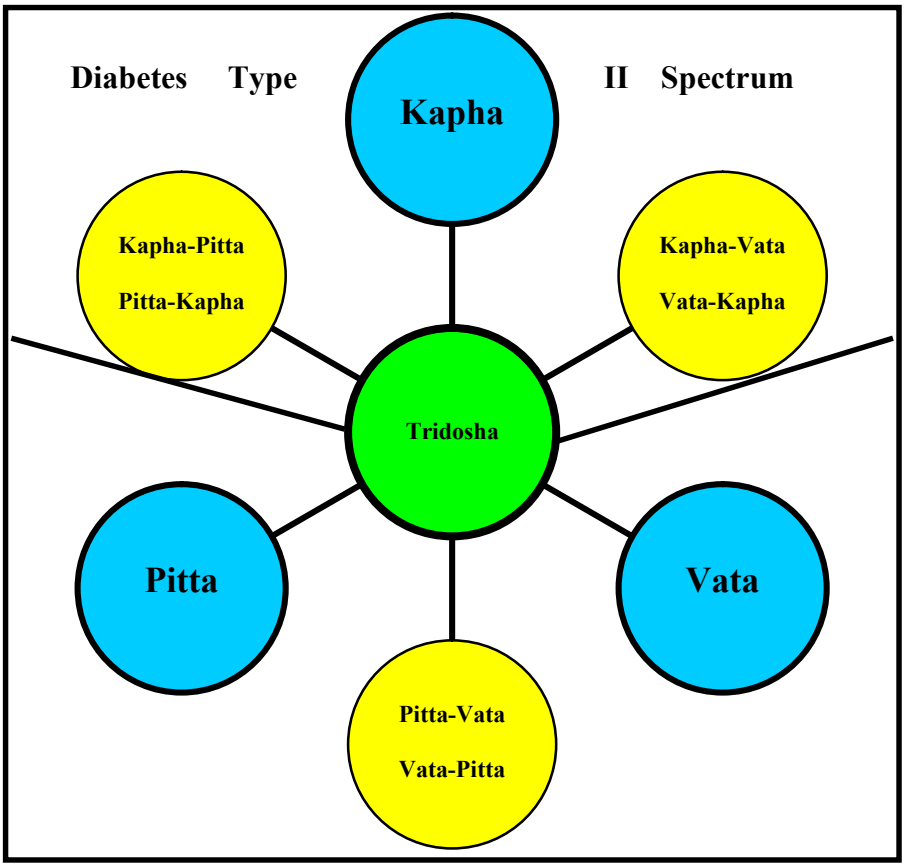
Statistical Analysis

The data were collected from source document for example *Prakriti* analysis from Ayusoft, Body Mass Index (BMI), chronicity of diabetes and all other epidemiological data were tabulated using Microsoft Excel 2007. The BMI was calculated using Quetelet's Index where BMI = weight (kg) / [height (m)]^2. The frequency of the *Prakriti* was evaluated and plotted in statistical package SBSS version 11.5.

6 RESULTS

PART 1) *Vikriti* and *Prakriti* Subtypes with Mean Western Diagnostic Tests

Diagram 1: Dosha Subtypes



This diagram demonstrates the complexity of dosha subtypes and the common diabetic spectrum of the disease. The primary dosha groups are Kapha, Pitta and Vata respectively but patients can be anyplace in a 360 degree spectrum depending if a certain dosha is dominant. For example Pitta-Kapha (pk) is Pitta predominant with Kapha values, likewise 2pk reflects that Pitta is double the Kapha value. This system is consistent with both Vikriti and Prakriti subgroups and is used in Tables 1,2 and 4.

The total patient number was diagnostically divided into Vikriti and Prakriti subgroups respectively and aligned with Western diagnostic diabetic methods of Fasting blood sugar, Mean Hba_{1c} and Mean BMI.

Table 1: Vikriti

Baseline Results

Vikriti Subgoups	No. of patients	Mean Fasting Glucose (mg/dL)	Mean Hba_{1c} (%)	Mean BMI (kg/m^2)
2pk	1	172	8	25
2pkv	4	151	7	28
v	1	170	7	24
kv	2	168	11	24
pvk	3	205	8	29
2kpv	1	142	7	30
p	2	132	8	27
pv	4	150	7	27
k	2	188	7	31
pkv	2	99	7	27
pk	1	139	8	22
kpv	8	162	8	32

*Values are rounded to nearest whole number

* Definition of Vikriti terms: 2pk- pitta double the kapha, 2kpv- Kapha double the pitta and vata, v- vata, kv-kapha predominant vata, pvk- pitta predominant vata kapha, 2kpv-Kapha double the pitta and vata, p-pitta, pitta predominant vata, k-kapha, pkv-pitta predominant kapha vata, pk- pitta predominant kapha, kpv-kapha predominant pitta vata.

Table 2: Prakriti Baseline Results

Prakriti Subgroups	No. of patients	Mean Fasting Glucose (mg/dL)	Mean Hba_{1c} (%)	Mean BMI (kg/m^2)
kp	6	182	8	29
2pk	8	148	7	26
kpv	1	175	6	27
kp	5	165	7	27
pk	8	134	7	29
2kp	1	115	7	28
2kv	1	139	8	22
2kpv	2	155	7	28

*Values are rounded to nearest whole number

*Definition of Vikriti terms: kp-equal- equal Kapha pitta, 2pk-pitta double the kapha, kpv-equal kapha pitta vata, kp-Kapha predominant pitta, pk-Pitta predominant kapha, 2kp- kapha double the pitta, 2kv- Kapha double the vata, 2kpv-Kapha double the pitta and vata.

Table 3: Statistical Significance between Prakriti Groups and Subgroups in regard to Baseline FBG, Hba1c and BMI over the 3month period

ANOVA[a]

		Sum of Squares	df	Mean Square	F	Sig.
Base FFB	Between Groups	8077.65	5	1615.53	1.20	.356
	Within Groups	20202.19	15	1346.81		
	Total	28279.84	20			
Base Hba_{1c}	Between Groups	3.15	5	.630	.90	.504
	Within Groups	10.46	15	.697		
	Total	13.61	20			
Base BMI	Between Groups	41.03	5	8.21	.25	.934
	Within Groups	494.21	15	32.95		
	Total	535.24	20			

a. random_gr = True group

Table 4: Mean Total Values for Fasting Glucose, Hba_{1c} and BMI

	Fasting Blood Glucose (mg/dL)	**HbA_{1c} (%)**	**BMI (kg/m^2)**
Mean Total	157	8	27

*Values rounded to nearest whole number.

Refer to Appendix 1 and 2 to view the reference values for Fasting Glucose, Hba_{1c} and BMI values used in clinical practise.

PART 2) Common Ayurvedic Diabetic medications and relationship to change in medication regime

Table 5: The highest frequency medication ingredients across all *Vikriti* Sub Groups

No. times used	Medication Name
29	Amrutha Choornam
24	Chandraprabhavatika
24	Kallyanakam Kashayam
22	Sreevaradi Kashayam
21	Kanmada Bhasmam
18	Kathaka Khadiradi Kashayam
17	Diajith
14	Dhanwantharam Gritham
11	Gaythari Kashayam

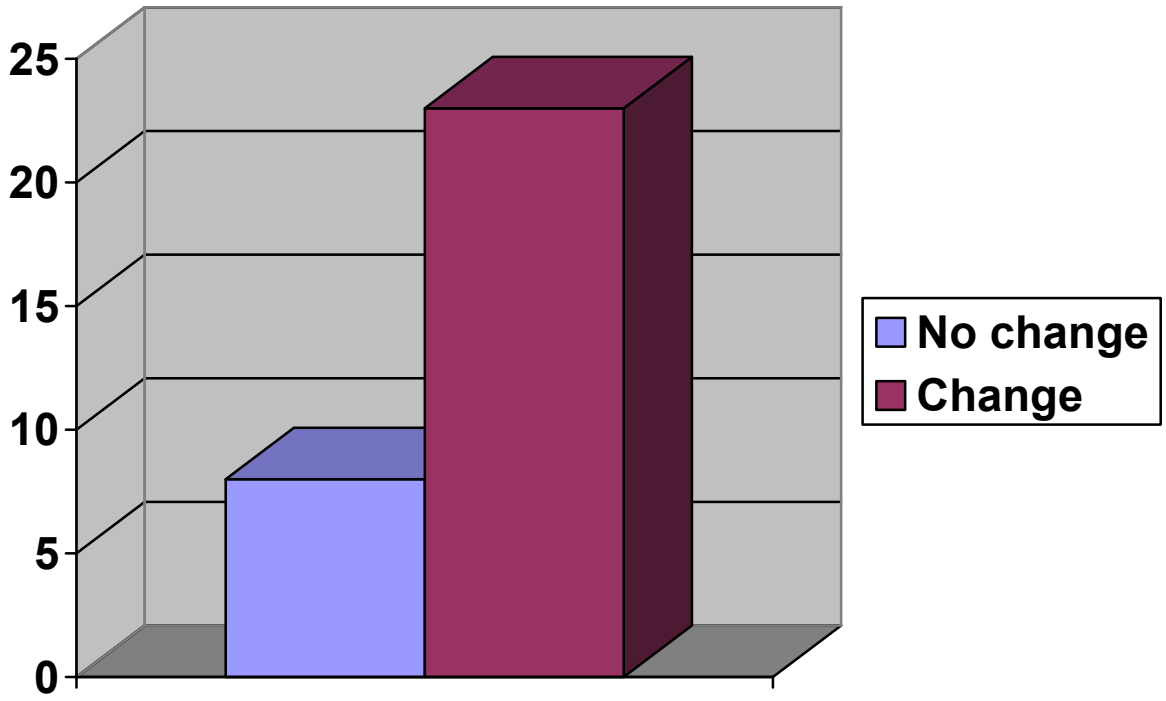
Table 6: Frequency of Medications used in *Pitta* and *Kapha* predominant *Vikriti*

Code	*Prameha* Indication	Pitta Predominant Frequency	Kapha Predominant Frequency
Sreevaradi Kashayam	Pitta and Vatta predominant	11	7
Kallyanakam Kashayam	Pitta predominant Tridosha	16	10
Chandraprabhavatika	Pitta predominant Tridosha	15	8
Kanmada Bhasmam	Tridosha	13	8
Kathaka Khadiradi Kashayam	Tridosha	10	7
Diajith	Tridosha	10	6
Dhanwantharam Gritham	Tridosha	6	6
Gaythari Kashayam	Kapha and Pita Predominant	6	5
Amrutha Choornam	Tridosha	16	12
Shad-Dharana Choornam	Pitta and Vata Predominant	6	3
Gudoochyadi Kashayam	Pitta Predominant	8	0
Sahacharadi Thailam (B)*	Pitta Predominant	4	5
Narayana Thailam (B)*	Pitta and Vata Predominant	6	4
Pinda Thailam*	Pitta and Vata Predominant	5	2

* External Oils

In the patient base *Vikriti* was presented in 12 subgroups. 7 of these subgroups are *Pitta* predominant (2pk, 2pkv, pkv, p, pv, pkv, pk), 4 were *Kapha* predominant (kv, 2kpv, k, kpv) and 1 *Vatta* predominant (v).

Diagram 2: Change in Medication Regime over 3month research period



This diagram reflects that 23 of 32 patients received a change in medication regime over the 3 month research period.

Part 3) Change in Base FBG, Hba1c and BMI over 3month period

Table 7: Mean changes in Base FBG, Hba_{1c} and BMI over 3month period in regard to Prakriti sub groups.

Prakriti Sub Groups and No.		Base FBG (mg/dL)	3M FBG (mg/dL)	Base Hba_{1c} (%)	3M Hba_{1c} (%)	Base BMI	3M BMI
kp- equal Kapha pitta	6	181.55	147.57	7.88	7.72	28.99	28.55
2pk- pitta double the kapha	8	148.03	128.23	7.43	7.49	26.49	26.53
kpv-equal kapha pitta vata	1	174.9	108.20	6.20	6.80	26.64	25.95
kp- Kapha predominant pitta	5	165.18	125.24	7.04	6.94	26.83	27.13
pk- Pitta predominant kapha	8	133.75	155.16	7.40	7.14	28.74	29.12
2kp- kapha double the pitta	1	115	84.50	6.50	7.80	27.90	27.69
2kv- Kapha double the vata	1	139	185.10	8.20	8.30	22.28	22.28
2kpv- Kapha double the pitta and vata	2	154.90	103.20	7.00	7.20	27.72	27.54

Table 8: Change in Base FBG, Hba_{1c} and BMI over 3month period in regard to True Group and Placebo Group.

		Base FBG (mg/dL)	3M FBG (mg/dL)	Base Hba_{1c} (%)	3M Hba_{1c} (%)	Base BMI (kg/m^2)	3M BMI (kg/m^2)
True group	Mean	154.59	132.95	7.46	7.40	28.38	28.21
	N	21	21	21	21	21	21
	SD	37.60	24.3	.83	.71	5.17	5.09
Placebo	Mean	151.06	144.56	7.20	7.27	26.02	26.16
	N	11	11	11	11	11	11
	SD	45.00	48.28	.71	.89	4.08	4.70
Total	Mean	153.38	136.82	7.38	7.36	27.57	27.55
	N	32	32	32	32	32	32
	SD	39.61	33.78	.785	.76	4.89	4.99

Table 9: Statistical Significance of change in Baseline Fasting Glucose, Hba_{1c} Group Group and Body Mass Index Group

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2 tailed)
				Lower	Upper			
Paired Differences of Base FBG – 3M FBG								
True	2.12	40.07	8.96	2.49	39.99	2.37	19	.028
Placebo	5.41	73.53	23.25	-47.19	58.01	.233	9	.821
Paired Differences of Base Hba_{1c} – 3M Hba_{1c}								
True	.057	.59	.13	-.21	.33	.44	20	.664
Placebo	-.10	.64	.20	-.56	.36	-.50	9	.632
Paired Differences of Base BMI – 3M BMI								
True	.17	.63	.14	-.12	.46	1.23	20	.233
Placebo	-.14	.72	.23	-.66	.38	-.61	9	.558

7 DISCUSSION

PART 1

Diagram 1 demonstrates the complexity of dosha subtypes. The primary dosha groups are *Kapha*, *Pitta* and *Vata* respectively but patients can be anyplace in a 360 degree spectrum depending if a certain dosha is dominant. For example *Pitta-Kapha* (pk) is a *Pitta* predominant patient with *Kapha* characteristics. Likewise 2pk reflects that *Pitta* characteristics are double the *Kapha* characteristics with no *Pitta* characteristics in a patient. In the inclusion criteria we have specified the age group to between over 20years until 65years which specifically allows only *Pitta* predominant subgroups to be included. This is evident from our data as seen in Table 1 which contains 7 *Pitta* predominant subgroups.

Tables 1 and 2 reflect the total patient number diagnostically divided into *Vikriti* and *Prakriti* subgroups respectively. Then each subgroup was aligned with Western diagnostic diabetic methods of Fasting Blood Glucose, Hba_{1c} and BMI. The purpose of comparing *Vikriti* Subgroups and *Prakriti* Subgroups is to identify if there are any statistical significant trends using Western diagnostic values. As the patient data was received it became evident that there are too many sub groups for both *Vikriti* and *Prakriti* for the current sample size, thus for this investigation to be successful a different research approach must be undertaken. It is suggested that more precise inclusion criteria be made allowing for stratified random sampling be done for each subgroup. This will allow each subgroup to have sufficient patient numbers before proceeding to be statistically analysed. These changes must be implemented for this aim to be met. Table 3 represents the One-way ANOVA test to determine whether there is statistically significance between baseline values of *Prakriti* subgroups. This allows us to determine is there are statistical significant changes within the group itself and in-between the subgroups. There are no statistical significant changes in within this current sample size thus we can not conclude that there is statistical difference between the three baseline forms of FFG, Hba_{1c} and BMI. It is concluded that for the same reasons as mentioned above the current sample size is too small to accurately determine any relationship between *Prakriti* subgroups.

Table 4 depicts Mean Fasting Glucose, Mean Hba_{1c} and Mean Body Mass Index in the patient base. Fasting blood glucose test allows doctors to determine whether a patient has or is at risk of pre-diabetes or diabetes. Irrelevant on the etiology of diabetes, an increased blood glucose level is a diagnostic marker for diabetes. Modern diagnostic criteria for diabetes states that for controlling Fasting Blood Glucose, 5-115mg/dL is excellent, 116-214mg/dL is good and 215 mg/dL and above is poorly controlled. All patients included in this study have a mean value of

157mg/dL indicating that under their current medical regime, whether on standard treatment or standard treatment combined with Ayurvedic treatment the patients have good controlled Fasting Blood Glucose. Like wise for Hba_{1c} levels for excellently controlled are 4-6%, good control is 7-8% and above 9% is poorly controlled. The mean percentage of Hba_{1c} across the sample size is 8% which is in the upper margin of good controlled levels. Hba_{1c} is a form of haemoglobin that is measured primarily to identify the average plasma glucose concentration over prolonged periods of time. The importance of Hba_{1c} in patients with diabetes is that it is a three months marker for control of blood glucose levels allowing for informed changes to medical medications to be made. Body Mass Index is strongly and independently associated with the risk of being diagnosed with type two diabetes. A healthy BMI is considered 18.5-24.9kg/m^2, overweight 25-29.9kg/m^2, obese 30-34.9kg/m^2 and severely obese 35kg/m^2 and greater. The mean BMI across the sample size is 27kg/m^2 categorising this sample as obese, thus justifying the relationship between BMI/obesity and diabetes mellitus type two.

PART 2

Ayurveda is renowned for its use of herbs in medicinal treatments. In this study it was wanted to research which Ayurvedic medications are commonly used in treating diabetes mellitus and its complications. The medication lists from patient charts were collected, tabulated and the frequency of use was determined as seen in Table 5. In the patient base *Vikriti* was presented in 12 subgroups. 7 of these subgroups are *Pitta* predominant (2pk, 2pkv, pkv, p, pv, pkv, pk), 4 were *Kapha* predominant (kv, 2kpv, k, kpv) and 1 *Vatta* predominant (v). In Table 6, the 7 *Pitta* predominant subgroups were grouped together and likewise the 4 *Kapha* subgroups to determine if there were any commonalities and differences between medications administered. As many of the subgroups have a mixed *Pitta, Kapha* and *Vata* component it is expected that broad (*tridosha*) medications be used that are able to cover each of these three categories. This was evident in the Table 6 as there are many medications used in both *Kapha* and *Pitta* predominant groups. There was a standout medication known as Gudoochyadi Kashayam that is a pure *Pitta* predominant medication that was never prescribed in *Kapha* predominant patients with a *Pitta* element. Due to the current inclusion criteria there is a bias towards *Pittaja* and *Kaphaja* stages of diabetes thus we see that in the medications used there is a bias towards *Pitta* and *Kapha* medications.

Here is a brief description of the indications of the most common *Prameha* (Diabetes) ingredients found in this study:

- Amrutha Choornam: Is given to all types of diabetics with musculoskeletal disorders, autoimmune, genitourinary disorders.
- Chandraprabhavatika: Is used in all types of diabetes associated with rheumatologic disorders, diabetic carbuncles, retinopathy and skin disorders.
- Sreevaradi Kashayam: It is useful in obesity, cures indigestion, cures headaches, stomach gas bloating, headache, abscess and wounds. It is also used as natural herbal diuretic, natural edema cures and is given to all the types of diabetics.
- Kanmada Bhasmam: It can be used for leucorrhoea, urinary stones and for burning micturation.
- Kathaka Khadiradi Kashayam: It is used in Ayurvedic diabetes management as it helps to relieve complications of diabetes such as neuropathy And takes care of skin complications that usually diabetic people suffer
- Diajith: Is used in all types of diabetics to reduce the blood glucose.
- Dhanwantharam Gritham; Used in diabetes and its complications, in abscesses, colics, piles, anaemia, swelling, ascites, convulsive disorders, rheumatic and nervous disorders.
- Kallyanakam Kashayam; Is used for conditions associated with neurodegenerative, autoimmune, psychological and infertility.
- Shreevaradi kashayam: Is given to all the types of diabetics to lower blood glucose and balance the doshas.
- Gaythari Kashayam: Is given to all the types of diabetics to lower blood glucose and balance the doshas.

Ayurvedic philosophy indicates that there is an emphasis to individualized patient care. Diagram 2 depicts the relationship between the number of patient consultations verse the number of times these consultations were made over the three month period. There are 32 patients in total with 8 patients not receiving a change of medications during consultations. The remained 23 had change in medication regime over the three month period equivalent to 72% and 14 patients had no change to their regime. This incite reflects that there is continuity in relationship and medicinal customization between the Ayurvedic Physician and the patient due to the regular consultation and medicinal maintenance for the purpose of comprehensive patient management.

PART 3

Table 7 represents changes within *Prakriti* groups over 3months of treatment. The same problems were faced as with Table 1 and 2 as not all subgroups are sufficiently represented due to the small sample size. The same suggestion is recommended that more precise inclusion criteria be made allowing stratified random sampling be done for each subgroup. This will allow each subgroup to have sufficient patient numbers before proceeding to be statistically analysed. These changes must be implemented for this aim to be met. Despite this, it is evident that Fasting Blood Glucose level lowers significantly across most groups and this will be interpreted in-depth in the following section.

The final step in the analysis of this patient base was to assess if there was any statistical significance over the three month time period for FBG, Hba_{1c} and BMI. Table 8 depicts the change in Base FBG, Hba_{1c} and BMI over 3month period in regard to True Group and Placebo Group. In comparing True Group and Placebo group there is a noticeable decline in Fasting Blood Glucose levels in the True group by 21.64mg/dL versus the decline by 6.5mg/dL in the placebo group. In can be concluded that Fasting Blood Glucose was better managed using standard medication in combination with Ayurvedic treatment. In comparing Hba_{1c} and BMI groups there were no statistical significant changes. It was noted that when divided into Prakriti subgroups there was a trend that the true group value had moved in a positive treatment direction while the placebo group consistently moved in a negative treatment direction. These trends can only be confirmed with the prolongation of this study provided treatment regime is consistent. Hba_{1c} would not be expected to have any significant change over a 3month period as it itself is a 3 month blood glucose marker thus it is necessary for the continuation of this study to see accurate trends. Likewise BMI is not expected to have significant changes over a 3 month period and an extension of this research is necessary to see if Ayurvedic with conventional treatment combined has a beneficial result for a patient base.

Table 9 statistically prove the above trends. The students paired T Test method of statistical analysis was use for each three diagnostic methods for true group and placebo group. Fasting Blood Glucose in the True arm has a statistical significant value of 0.028 versus 0.821 for the placebo group. This confirms that in this population base combined conventional and Ayurvedic treatment is effective at lowering fasting blood glucose levels over a three months period. There were no statistically significant changes in conventional therapy group or

combined therapy for both Hba_{1c} and BMI reiterating the need for an extension of time to view a long term assessment of both treatment methods.

8 CONCLUSION

1. More precise inclusion criteria is needed allowing for stratified random sampling be done for each *Prakriti* and *Vikriti* subgroup. This will allow each subgroup to have sufficient patient numbers before proceeding to be statistically analysed.

2. The relationship between BMI/obesity and diabetes mellitus type two was justified.

3. Current inclusion criteria reflects a bias towards *Pittaja* and *Kaphaja* stages of diabetes thus we see that in the medications used there is a bias towards *Pitta* and *Kapha* medications.

4. There is continuity in relationship between the Ayurvedic Physician and the patient due to the regular consultations for the purpose of comprehensive patient management.

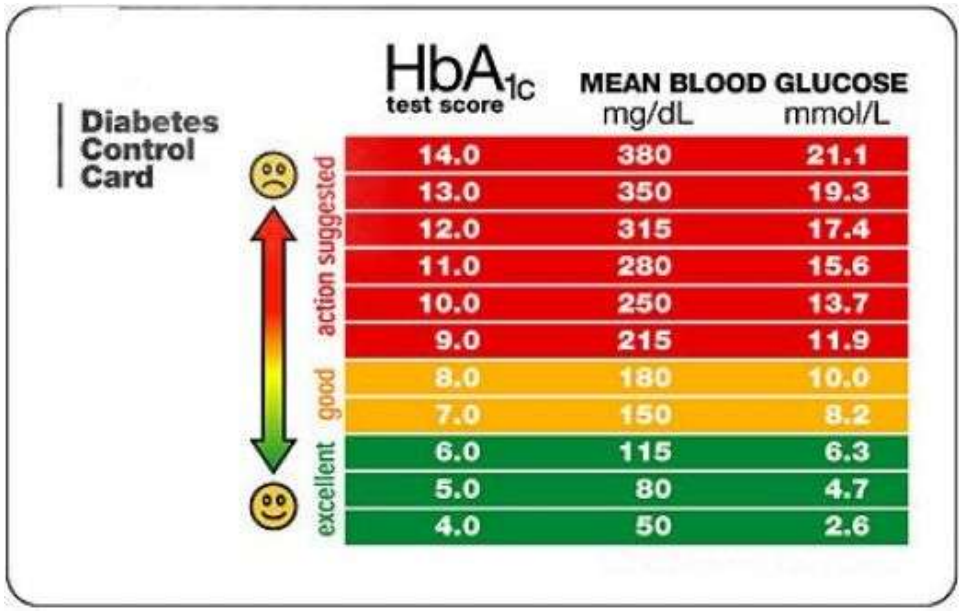
5. It was statistically proven that Fasting Blood Glucose significantly (sig. 0.028) decreases over a three month period on combined conventional and Ayurvedic medication while conventional medication alone was not statistically significant (sig. 0.821).

6. There were no statistically significant changes in conventional therapy group or combined therapy for Hba_{1c} reiterating the need for an extension of time to view a long term assessment of both treatment methods.

7. There were no statistically significant changes in conventional therapy group or combined therapy for both BMI reiterating the need for an extension of time to view a long term assessment of both treatment methods.

9. APPENDIX

Appendix 1: Hba_{1c} and Mean Blood Glucose control reference values



http://seamist.hubpages.com/hub/Hba_{1c}-test#

Appendix 2: BMI reference values

Weight Categories	BMI (kg/m²)
Underweight	< 18.5
Healthy Weight	18.5-24.9
Overweight	25-29.9
Obese	30-34.9
Severely Obese	35-39.9
Morbidly Obese	≥40

http://bariatrics.colquittregional.com/bmi-calculator/

Appendix 3: Prakriti Evaluation

Questionnaire for *Prakriti* evaluation

Personal information

Language and Ethnicity

Gender

Age

Height

Weight

Family history of Disease

.Vital Data

(a) Pulse Rate/min: ☐☐☐

(b) Blood Pressure (mmhg) ☐☐☐ ☐☐☐
Systolic Diastolic

(c) Wrist Circumference (inch) ☐☐

(d) Body frame by Wrist finger ratio ☐☐☐☐☐☐

(d) Waist Circumference (inch) ☐☐☐

(e) Hip Circumference (inch) ☐☐☐

(f) Forearm measurement (inch) ☐☐☐

(g) Waist-Hip ratio ☐☐☐

(h) B.M.I. ☐☐☐

10. ACKNOWLEDGEMENTS

Firstly, I would like to thank my God and my family in providing me with the opportunity to study medicine.

I am immensely thankful for the help and guidance provided by my supervisor Prof. Valdis Pīrāgs through my journey of Diploma research.

I express my gratitude towards Dr. Somit Kumar and colleges of the Arya Vaidya Chikitsalayam and Research Institute for their expertise and guidance in the field of Ayurvedic Medicine.

Last but not least I sincerely appreciate the support of Dr. Sintija Sausa for providing her expertise in Ayurveda.

A. Anatomical Features

A-1

	Symmetry		Shape		Length/Height			Breadth		
	Proportionate	Disproportionate	Regular	Irregular	Too Short / Too Long	Medium	Long	Thin / Narrow	Medium	Broad
Body Build	○	○								
Body Frame	○	○	○	○	○	○	○	○	○	○
Head	○	○	○	○						
Forehead	○	○			○	○	○	○	○	○
Face	○	○	○	○						
Eyebrows			○	○						
Eyes	○	○	○	○						
Lips			○	○						
Jaws			○	○						
Shoulder			○	○				○	○	○
Chest	○	○	○	○				○	○	○
Hands	○	○			○	○	○			
Palms	○	○								
Nails					○	○	○			
Legs	○	○			○	○	○			
Soles	○	○								
Joints	○	○								

A-3 Skin

Nature		Texture		Appearance		Colour	
Dry	○	Smooth	○	Cracked	○	Fair	○
Oily	○	Firm	○	Wrinkled	○	Dark	○
Normal	○	Lustrous	○	Moles	○	Reddish	○
Seasonal/Variable	○	Soft	○	Marks	○	Pale Yellow	○
Thick	○	Loose	○	Pimples	○	Pink	○
Thin	○	Rough	○	Freckles	○	Wheatish	○
Hard	○	Coarse	○	Clear	○	Golden	○
				Prominent Veins	○	Fresh Colour	○
						Dusky	○

A-4 Scalp hair

Texture		Nature		Growth /Bulk	
Thick	○	Graying	○	Dense	○
Thin	○	Falling	○	Scanty	○
Coarse	○	Breaking	○	Moderate	○
Hard	○	None	○	Bald	○
Smooth	○	Dry	○		
Soft	○	Oily	○		
Straight	○	Normal	○		
Wavy	○	Seasonal/Variable	○		
Fizzy/Curly	○				

A-5

Colour	Scalp hair	Body hair
Black	○	○
Dark Brown	○	○
Light Brown	○	○
Dusky	○	○
Blonde	○	
Copper	○	○

A-2 Size / Bulk / Musculature

	Small / Weakly developed/ thin	Medium / Moderately developed	Large / Big / Well developed
Body Build	○	○	○
Joints	○	○	○
Face	○	○	○
Eyes	○	○	○
Eyebrows	○	○	○
Eyelashes	○	○	○
Lips	○	○	○

A-6 Eye

Colour		Appearance	
Black	○	Dry/Dull	○
Dark Brown	○	Dim in luster	○
Light Brown	○	Shiny	○
Greyish	○	Milky white sclera	○
Blue	○	Reddish tinge to sclera	○
Green	○	Muddy sclera	○

A-7 Teeth

Size		Appearance		Shape		Color	
Too small	○	Brittle/ Cracked	○	Regular	○	Milky white	○
Too large	○	Loose	○	Irregular	○	Yellowish	○
Medium	○	Lustrous	○	Even	○	Dull / blackish	○
Large	○			Uneven	○		

A-8 Complexion

	Colour				Nature							
	Dark	Reddish	Pale Yellow	Pink	Smooth	Firm	Soft	Rough	Brittle / Cracked / Split	Wrinkled	Flat	Convex
Palms	○	○	○	○	○	○	○	○	○	○		
Soles	○	○	○	○	○	○	○	○	○	○		
Lips	○	○	○	○	○	○	○	○	○	○		
Nails	○	○	○	○	○	○	○	○	○		○	○
Palate	○	○	○	○								

B. Physiological Functions

B-1 Metabolism

	Frequency					Amount				
	Regular	Irregular	Frequent	Infrequent	Medium	Variable	Low	High	Medium	Variable
Appetite	○	○	○	○	○	○	○	○	○	○
Thirst	○	○	○	○	○	○	○	○	○	○
Bladder	○	○	○	○	○	○	○	○	○	○

B-2

	Amount			
	Low	High	Medium	Variable
Digestive Power	○	○	○	○
Perspiration	○	○	○	○
Body Temperature	○	○	○	○
Sleep	○	○	○	○
Dreams	○	○	○	○

B-3 Bowel habits

Frequency		Tendency towards	
Regular	○	Constipation	○
Irregular	○	Loose motion	○
Variable	○	None	○

Stool consistency

Loose / Soft / SemiSolid ○ Medium ○ Hard ○

B-4 Body odour

Strong	○
Mild	○
Very less	○

B-5 Quality of sleep

Deep	○
Sound	○
Shallow	○

B-6 Body weight changes

Gain and lose easily	○
Difficulty in gaining	○
Gain easily and lose with difficulty	○
Stable	○

B-7 Food

	Sweet	Sour	Salty	Bitter	Pungent	Astringent	Cold	Warm	Dry	Oily
Like	○	○	○	○	○	○	○	○	○	○
Does Not Like	○	○	○	○	○	○	○	○	○	○
Suit	○	○	○	○	○	○	○	○	○	○
Does Not Suit	○	○	○	○	○	○	○	○	○	○

B-8

Weather	Prefer	Have health problems
Cold	○	○
Warm	○	○
Dry	○	○
Moist	○	○
Moderate	○	○
Stable	○	○

B-9

Season	Prefer	Have health problems
Summer	○	○
Early winter	○	○
Late winter	○	○
Autumn	○	○
Spring	○	○
Rainy season	○	○
Season transition	○	○
None	○	○

C. Physical Activities

C-1 Walking

Speed		Steps		Amount		Style	
Quick / Fast / Brisk	○	Small	○	Less	○	Firm / Steady	○
Medium	○	Medium	○	High / Excessive	○	Unsteady	○
Slow	○	Large	○	Moderate	○	Sharp / accurate	○
Variable	○						

C-2 Working

Speed		Quality		Style / Accuracy	
Quick/Fast/Brisk	○	Well thought of	○	Firm / Steady	○
Medium	○	Wavering / Easily deviated	○	Unsteady	○
Slow	○	Sharp/Accurate/Spontaneous	○	Sharp / Accurate	○
Variable	○				

C-3 Voluntary / Involuntary movements of body parts

	Eyes	Eyebrows	Jaw	Lips	Tongue	Head	Shoulder	Hands	Legs
Less	○	○	○	○	○	○	○	○	○
Moderate	○	○	○	○	○	○	○	○	○
High / Excessive	○	○	○	○	○	○	○	○	○

C-4

	Quality of voice		Content of speech	
Low ○	Good tone	○	Consistent	○	Convincing	○
Feeble ○	Sharp	○	Inconsistent	○	Argumentative	○
Weak ○	Clear	○	Moderate	○	Sweet and pleasing to ears	○
Broken ○	High pitched	○	Well guarded / Well thought of	○	Avoid confrontations	○
Rough ○	Loud	○	Wavering / Easily Deviated	○	Deviated from main topic	○
Deep ○	Soft, pleasing	○	Sharp / Accurate / Spontaneous	○	Irrelevant in between	○

C-5 Speaking

Speed		Amount	
Quick / Fast / Brisk	○	Less	○
Medium	○	Moderate	○
Slow	○	Excessive	○
Variable	○		

D. Strength at Various Levels

D-1

Physical		Mental		Resistance Power		Healing Power	
Grade 1	○	Grade 1	○	Grade 1	○	Grade 1	○
Grade 2	○	Grade 2	○	Grade 2	○	Grade 2	○
Grade 3	○	Grade 3	○	Grade 3	○	Grade 3	○

E. Psychological Functions

E-1 Speed

	Quickly	Moderately	Slowly	Variably
Memorizing	○	○	○	○
Forgetfulness	○	○	○	○
Recalling	○	○	○	○
Initiation	○	○	○	○
Making new friends	○	○	○	○
Anger	○	○	○	○
Irritability	○	○	○	○

E-2 Quality

	Good / Firm/ Stable / High	Medium	Poor / Wavering / Unstable
Retaining	○	○	○
Planning	○	○	○
Execution	○	○	○
Achieving ends	○	○	○
Retaining friends	○	○	○
Anger	○	○	○
Forgiveness	○	○	○
Generosity	○	○	○
Faith and beliefs	○	○	○

E-3 Memory type

	Good	Poor
Olfactory	○	○
Auditory	○	○
Tactile	○	○
Gustatory	○	○
Visual	○	○

11. BIBLIOGRAPHY

Ali N. (2011). Diabetes and You, Rowman & Littlefield Publishers Inc, Lanham, Pages 15-16, 182-189. ISBN 978-1-4422-0728-8.

Ayurvedadosha. (2015). The Tridosha System. Retrieved from: http://ayurvedadosha.org/doshas#axzz3FouhKBww

Bagde A, B., Sawant R, S., Sawai R,V., Muley S,K., Dhimdhime R.S. (2013). Charak Samhita – Complelete Encyclopedia of Ayurvedic Science, IJAAM 1(1), 12-20.

Bhalerao S., Deshpande T., Thatte U. (2012). Prakriti (Ayurvedic concept of constitution) and variations in platelet aggregation. BMC Complementary and Alternative Medicine, 12:248.

Cavanagh D and Willis, C. (2004*).* Essential Ayurveda - The Practical Guide to Healthy Living. Ayurveda Services Limited, Burton-on-Trent, Pages 29-56.

Challem J and Hunninghake R. (2007). Stop prediabetes now: the ultimate plan to lose weight and prevent diabetes, John Wiley & Sons Inc, Hoboken, Pages 19-76. ISBN 978-0-470-12173-3

Chan J,C., Ng M,C., Critchley J,A., Lee S,C., Cockram C,S. (2001) Diabetes mellitus--a special medical challenge from a Chinese perspective. Diabetes Res. Clin. Pract. Nov;54 Suppl 1:S19-27.

Chatterjee1, B and Pancholi, J. (2011) Prakriti-based medicine: A step towards personalized medicine AYU Journal Apr-Jun 2011 Vol 32 Issue 2, pages 141-146.

Feinglos M,N and Bethel M,A. (2008). Type2 Diabetes Mellitus An Evidence-Based Approach to Practical Management, Humana Press, Totowa, Pages 49-75. ISBN: 978-1-58829-794-5

Frawley D and Ranade S. (2001). Ayurveda, Nature's Medicine, Lotus Press, Twin Lakes, pages 181-191. ISBN: 0-914955-95-0.

Ganguli K,M. (2003). The Mahabharata of Krishna-Dwaipayana Vyasa. sacred-texts.com, Book 12: Santi Parva: Rajadharmanusasana Parva: Section XXXVII, pages 75-188.

Gordon B,A., Bird S,R., MacIsaac R,J., and Benson A,C. (2013). Glycemic response varies between resistance and aerobic exercise in inactive males with long-term type 2 diabetes. Appl. Physiol. Nutr. Metab. 38: 900–904.

Gordon L,A., Morrison E,Y., McGrowder D,A. (2008). Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes. BMC Complement Altern Med;8:21–30.

Government of India. (2007). The Ayurvedic Pharmacopedia of India Formulations Volume 1. Ministry of Health and Family Welfare Department of Ayurveda. Yoga and Naturopathy, Unanai, Siddha and Homoeopathy, New Delhi, Pages 56-57.

Guggulutiktakam Kashayam (16/10/2014). Retrieved from http://www.ayurpages.com/guggulutiktakam-kashayam-indication-doses-side-effects-ingredients-ayurvedic-properties-reference-manufacturers/

Hankey, A,. (2001) Ayurvedic physiology and etiology: Ayurvedo Amritanam. The doshas and their functioning in terms of contemporary biology and physical chemistry. J Alt.Compl.Med 7(5), 567–573.

Hankey, A,. (2005) The Scientific Value of Ayurveda. J.Alt.Compl.Med. 11(2), 221-225.

Holt R.I.G., Cockram C.S., Flyvbjerg A and Goldstein B.J. (2010). Textbook of Diabetes 4th Edition, John Wiley & Sons, Singapore, Pages 553-746. ISBN: 9781405191814.

Holt R,I,G and Hanley N, A. (2012). Essential Endocrinology and Diabetes 6th edition, John Wiley & Sons Ltd, Chichester, pages 344-357. ISBN-13: 978-1-4443-3004-5.

Holt T and S Kumar S. (2010). ABC of Diabetes 6th edition, John Wiley & Sons Ltd, Chichester, pages 19-79. ISBN 978-1-4051-7784-9.

Holy Herbaceuticals. (03/032015). Ayurvedic Diabetes (Madhumeha) Cure. Retrieved from: http://www.holycrystals.in/diabetes-cure-in-ayurveda-madhumeha/

Hope-Murray A. (2013). Ayurveda For Dummies, John Wiley & Sons Ltd, Chichester, pages 20-46, 83-106. ISBN 978-1-118-30670-3.

Hu F,B. (2011). Globalization of Diabetes. Diabetes Care 34:1249–1257.

Hussain A, Hydrie M,Z,I., Claussen B., Asghar S. (2010). Type 2 Diabetes and obesity: A review. Journal of Diabetology, June 2010; 2:1, 1-7.

Jayaprasad B and Sharavanan, PS. (2013) Overview of Diabetes in Ayurveda. Int.Res.J.Pharm. 4 (8).

King A,C. (2015). Treating Diabetes with Ayurveda and Yoga. The Chopra Center. Deepak, Pages 1-27.

Khare C, P. (2004). Indian Herbal Remedies - Rational Western Therapy, Ayurvedic and Other Traditional Usage, Botany. Springer-Verlag, New York, pages ?? . ISBN 978-3-642-62229-8.
(Khare 2004)

Khare C,P. (2007) Indian Medicinal Plants An Illustrated Dictionary, Springer Science+BusinessMedia, New Delhi, pages ??. ISBN: 978-0-387-70637-5.
(Khare 2007)

Lad V,D. (1984). Ayurveda the science of self healing a practical guide. The Ayurvedic Press, Santa Fe, page 1-53.

Lad V,D. (1998) The Complete Book of Ayurvedic Home Remedies, Three Rivers Press, New York, page 1-9, 101-102.

Lad V,D. (2002). Textbook of Ayurveda. The Ayurvedic Press, Albuquerque, page 29.

Lad V,D. (2003). Ayurveda a brief introduction and guide. The Ayurvedic Press, Albuquerque, page 1-5.

Lad V,D. (2006) Secrets of the Pulse. The Ayurvedic Press, Santa Fe, page 1-24.

Leslie R,D., Lansang M,C., Coppack S., Kennedy L. (2012). Diabetes Clinicians Desk Referance, Manson Publishing Ltd, London, pages 37-120.

Loon G V. (2003). C'haraka Samhita Handbook on Ayurveda Volume II. Chaukhambha Orientalia Publishers, Dehli, Pages 1078-1098.

Mahapure, H. H., Shete, S. U., & Bera, T. K. (2008). Effect of yogic exercise on super oxide dismutase levels in diabetics. Int.J. Yoga, 1(1), 21–26.

Manmatha M,A. (1891).The Ramayana. Deva Press, Calcutta, pages 1-501.

Mccullock D,K. (2008). The diabetes answer book: practical answers to more than 300 top questions, Sourcebooks Inc. Naperville, pages 172-175. ISBN-13: 978-1-4022-2062-3.

Mehmood G,S., Shahani A,K., Pal S., Shirodkar J,A., Gopal G. (2011) Computer Simulation Modelling for the Prevenstion of Diabetes Mellitus (Prameha), J.Apllied Sciences 11 (15), 2670-2679.

Meulenbeld G,J and Wujastyk D. (2001). Studies on Indian Medical History, Groningen: Forsten, New Delhi, pages 1-15. ISBN-10: 8120817680.

Mohan V., Sandeep S., Deepa R., Shah B., Varghese C. (2007). Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res. Mar;125(3), 217-30.

Morgan, K. (1994). Ayurveda - Medicine of the Gods, Mandrake of Oxford, Marsh Lake, pages 10-30.

Mishra L,C. (2004). Scientific Basis for Ayurvedic Therapies, CRC Press LLC, Boca Raton. Page 7-8, 105. ISBN 0-8493-1366-X

Naik, N (03/03/2015). How To Rebalance Your Ayurvedic Doshas. Retrieved from: http://d3bg4fkc00gz5m.cloudfront.net/Niraj/HowToBalanceYourDoshas.pdf

NNCAM. (2007). Mind-Body Medicine: An Overview. Retrieved from http://www.qigonginstitute.org/html/papers/NCCAMmindbody.pdf

Parameshvara, V (2005). Encyclopaedia of India Medicine Project Vol.2. Popular prakashan Pvt Ltd, Mumbai, pages 77.

Patwardhan B., and Bodeker G,. (2008) Ayurvedic genomics: establishing a genetic basis for mind-body typologies. J Altern.Complement.Med. 14(5), 571-6.

Pole, S (2006). Ayurvedic Medicine The Principles of Traditional Practice. Elsevier Ltd, Philadelphia, Page 13, 49-67. ISBN-13 978-0-443-10090-1.

Prasher B., Negi S., Aggarwal S., Mandal A,K., Sethi T,P., Deshmukh S,R., Purohit S,G., Sengupta S., Khanna S., Mohammad F., Garg G., Brahmachari S,K., Mukerji M. (2008) Whole genome expression and biochemical correlates of extreme constitutional types defined in Ayurveda. J Transl Med. 2008 Sep 9;6:48.

Puri H,S. (2003). Rasayana Ayurvedic herbs for longevity and rejuvenation, Taylor & Francis, London, pages 4-6. ISBN 0-203-21656-3.

Purkait P., and Bhattacharya M. (2012) Prameha and its Ancient Ayurvedic Medicine in India. Jr.Anth. Survey of India, 6(2), 659-669.

Ramachandran A., Snehalatha C., Kapur A., Vijay V., Mohan V., Das A,K., Rao P,V., Yajnik C,S., Prasanna Kumar K,M., Nair J,D. (2001). High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. Diabetologia. Sep;44(9),1094-101.

Rizzo-Sierra C,V. (2011). Ayurvedic genomics, constitutional psychology, and endocrinology: the missing connection. J.Alt.Compl.Med. May;17(5), 465-468.

Rohit S., Hetal A., Galib., Prajapati P,K. (2012). Astasthana Pariksha - A Diagnostic Method of Yogaratnakara and its Clinical Importance.GJRMI May 1(5), 186–201.

Ross A. and Thomas S. (2010) The Health Benefits of Yoga and Exercise: A Review of Comparison Studies. J.Alt.Compl.Med 16 (1), 3–12.

Savrikar S,S. and Ravishankar, B. (2010) Bhaishajya Kalpanaa – The Ayurvedic Pharmaceutics – An Overview. Afr.J.Trad. CAM 7(3), 174-184.

Svoboda R. (2005). Prakriti: Your Ayurvedic Constitution, Lotus Press, Kandern, Pages 15-31. ISBN: 096562083.

Tarabilda E,F. (1997). Ayurveda Revolutionised – Integrating Ancient and Modern Ayurveda, Lotus Press, Twin Lakes, pages 41-44. ISBN: 0-914955-38-1.

Tiwari A,K. (2005). Wisdom of Ayurveda in perceiving diabetes: Enigma of therapeutic recognition. Current Science, 88(7), 1043-1051.

Tirtha S,S. (2005). The Ayurveda Encyclopaedia, Ayurveda Holistic Center Press, Bayville, pages 3-8, 457, 576-577. ISBN-13: 978- 0-9658042-8-8.

Srinivas P, Prameela Devi K, Shailaja B. (2014). Diabetes Mellitus (Madhumeha) – An Ayurvedic Review, Int.J.Pharm.Pharmaceu.Sci. 6(1), 107-110.

Vaghela B., Soni H,. Shukla, L. (2013). A Concept of Herbal In Pratinidhi Dravyas Substitute drugs Ayurveda. Pharmagene 1(3), 85-88.

Warrell D.A., Cox T.M., Firth J.D., Edward J., Benz M.D. (2003). Oxford Textbook of Medicine 4th edition, Oxford Press, Oxford, Pages 129-131. ISBN: 0-1926-2922-0.

Weber W. and Killen J. (2009). Ayurvedic Medicine: An Introduction. Retrieved from: https://nccih.nih.gov/sites/nccam.nih.gov/files/Get_The_Facts_Ayurvedic_Medicine_07-16-2013.pdf

World Health Organisation. (2002). Policy Perspectives on Medicines. Retrieved from: http://apps.who.int/medicinedocs/pdf/s2293e/s2293e.pdf

World Health Organisation. (2015). Country and regional data on diabetes. Retrieved from: http://www.who.int/diabetes/facts/world_figures/en/

Wujastyk, D, (1998). The Roots of Ayurveda, New Delhi, Penguin Books India, pages1-38.

Young, J. (2007). Complementary Medicine for Dummies, John Wiley & Sons Ltd, Chichester, pages 55-57. ISBN: 978-0-470-02625-0.

12 ETHICS COMMITTEE EVALUATION

The Arya Vaidya Pharmacy (Coimbatore) Limited
Regd. & H.Office: 42, Perumal Koil Street, Ramanathapuram, Coimbatore- 641 045
Phone: +91-422-2315412, 2316006, 2316220.Fax: +91-422-2310083
Email:avpcbe@gmail.com Website: www.avpayurveda.com

Kanjikode
12/11/13

To

The principal Investigator
Research on A RANDOMIZED DOUBLE BLIND PARALLEL GROUP PLACEBO CONTROLLED STUDY TO INVESTIGATE THE EFFICACY AND SUSTAINABILITY OF INTEGRATED AYURVEDIC TREATMENT IN TYPE 2 DIABETES ON TOP OF PRE-EXISTING ANTI DIABETIC THERAPY
The Ayurvedic Trust
Coimbatore

Dear Dr.Krishnakumar .

With reference to the e- mail from Dr.Somit kumar Co-Investigator reg the study protocol and the relevant details of the study, the IRB convened and had opined on various issues .

The subsequent e-mails dated 10/11/13 and 12/11/13 from Dr.Somit Kumar addressed the queries, putforth by the IRB .

Based on these discussions and reviews ,The protocol for the study titled - **A RANDOMIZED DOUBLE BLIND PARALLEL GROUP PLACEBO CONTROLLED STUDY TO INVESTIGATE THE EFFICACY AND SUSTAINABILITY OF INTEGRATED AYURVEDIC TREATMENT IN TYPE 2 DIABETES ON TOP OF PRE-EXISTING ANTI DIABETIC THERAPY**
- is approved by the Institutional review board, Ayurvedic trust, Coimbatore

Yours sincerely

Dr.Sindhu .A
Chair person
Institutional Review Board
The Ayurvedic trust
Coimbatore

Factory, Opp.Railway Station, Kanjikode, Palakkad, Kerala -678621
Phone: +91-4912566222, 2569224, 2566322, 2566235
Email: avpkanjikode@gmail.com