

Bioactive Molecules from Traditional Indian Products

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Presentation Structure

- ▶ Traditional Knowledge and Modern Sciences: Epistemological Variance
- ▶ Indian Traditional Healthcare-Ayurveda's Concepts of Dietetics and Health Foods
- ▶ The path of reverse Nutraceuticals and Dietetics: Experience-Experiments-Evidence
- ▶ Traditional Indian products: Bio-molecules and Biological plausibility
- ▶ Exemplified by *Haridra/Turmeric*, *Amala/Gooseberry*, *Shunthi/ginger*, *Kulattha/horsegram*, *Madhu/Honey*

Traditional Knowledge & Science

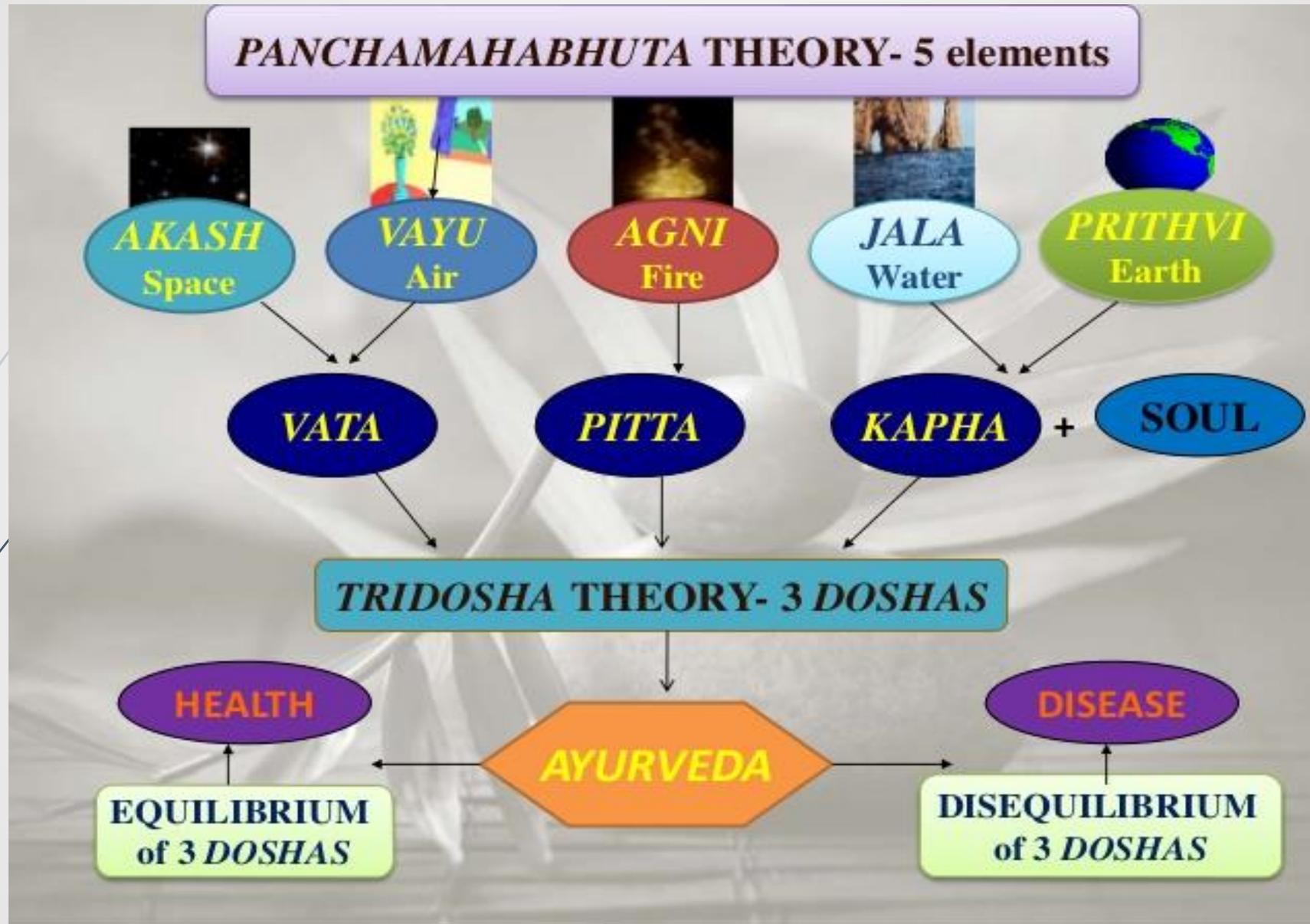
Ways of knowing about nature/environment, depth, range,

- Scope of knowledge discovered in traditional knowledge systems and science fundamentally different,
- Modern science: detailed knowledge about parts of physical & biological nature
- Traditional knowledge systems: holistic knowledge of physical, biological, and spiritual fields that pervade nature
- Outside world and the being –understood on ontological basis of *pancamahabhutas*
- Five elements-earth, water, fire, air, and space --- correspond to each of the 5 senses, viz. smell, taste, vision, touch, and sound.

Challenge to integrate reductionist framework of modern science with holistic framework of traditional knowledge systems

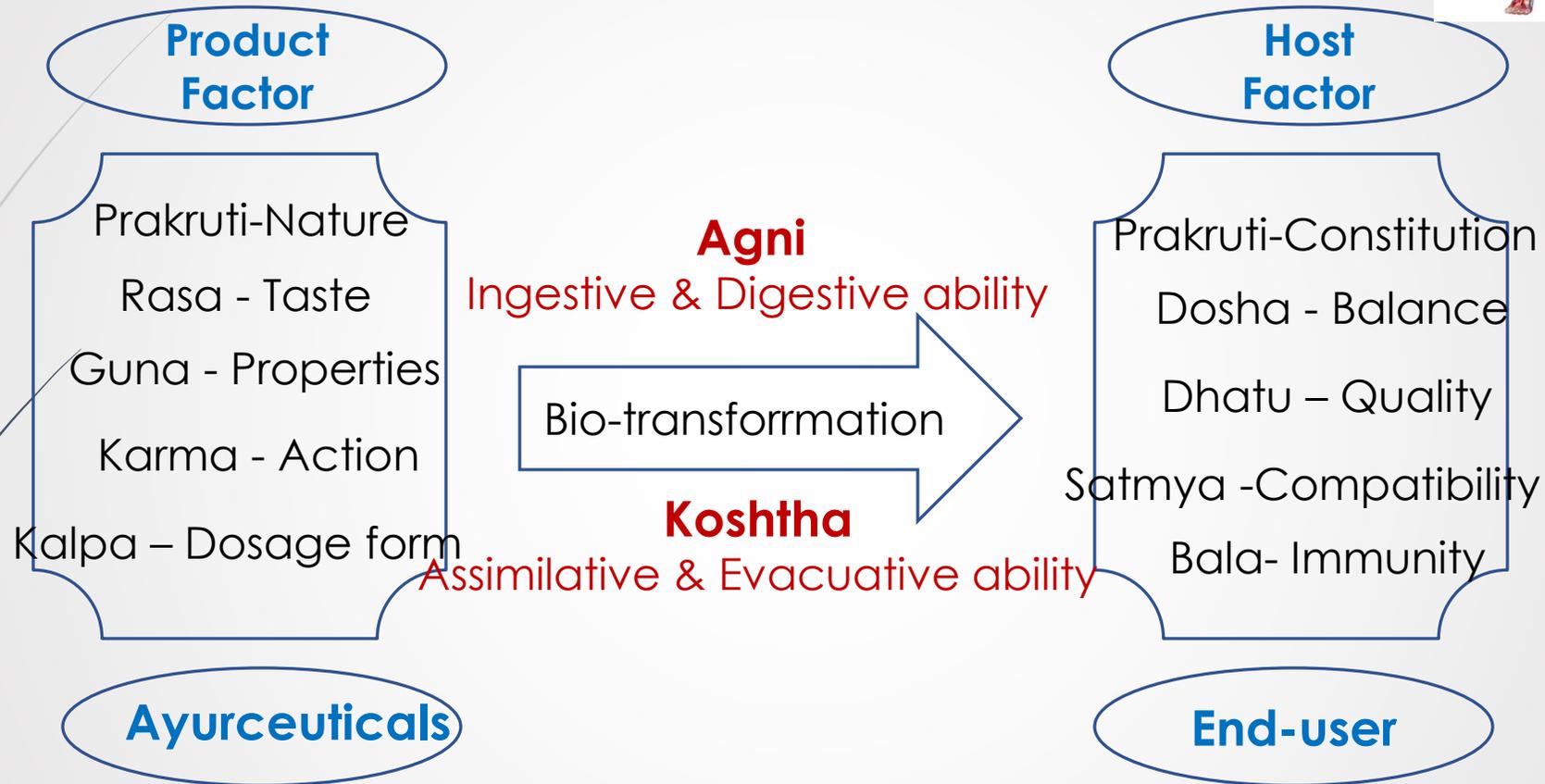
Ayurvedic Doshas







Determinants of Ayurvedic Ingredients



Sub-stratification of OTC – Ayurceuticals is Desirable At Product development and Dietetic practice level



Godhuma



Barley



Vrihi/
Rice



Masha/Udad



Priyangu
*Callicarpa
macrophylla*

Anna



Anna Aushadis



Barley



Kulith



Udad/Black gram



Shadangoda
k



Priyangu/ Charoli
*Buchanania
cochinchinensis*



Upavaka/Indrayava
Holarrhena antidysenterica



Principles of Dietetics and Food types

*Aharprabhavam Vastu Rogashcha Ahar Sambhavaah I
Hitahitam Visheshanshcha Visheshah Sukha-Dukhhayoho II*

Eating Guidelines

- ❖ Ushna (Hot & warm food)
- ❖ Snigdha (Unctuous food)
- ❖ Maatraavad (Proper quantity)
- ❖ Jeerne (After digestion)
- ❖ Veeryaviruddhe (Avoid incompatible food)
- ❖ Naatidruta (Not too fast ...)
- ❖ Naativilambita (Not too slow...)
- ❖ Ishtadeshe (Pleasant ambience)
- ❖ Ishtasarvopakarane (Equipped with utensils)
- ❖ Ajalpannahasana (Avoid talking & laughing)
- ❖ Tanmanabhunjit (with full attention)
- ❖ Aatmaamabhisameekshya (Due regard to oneself)

Determinants of food utility

- ❖ ***Prakruti***
- ❖ ***Samyoga***
- ❖ ***Samskara***
- ❖ ***Matra***
- ❖ ***Desha***
- ❖ ***Kala***
- ❖ ***Upayogsamstha***
- ❖ ***Upyokta***

Food groups Classification

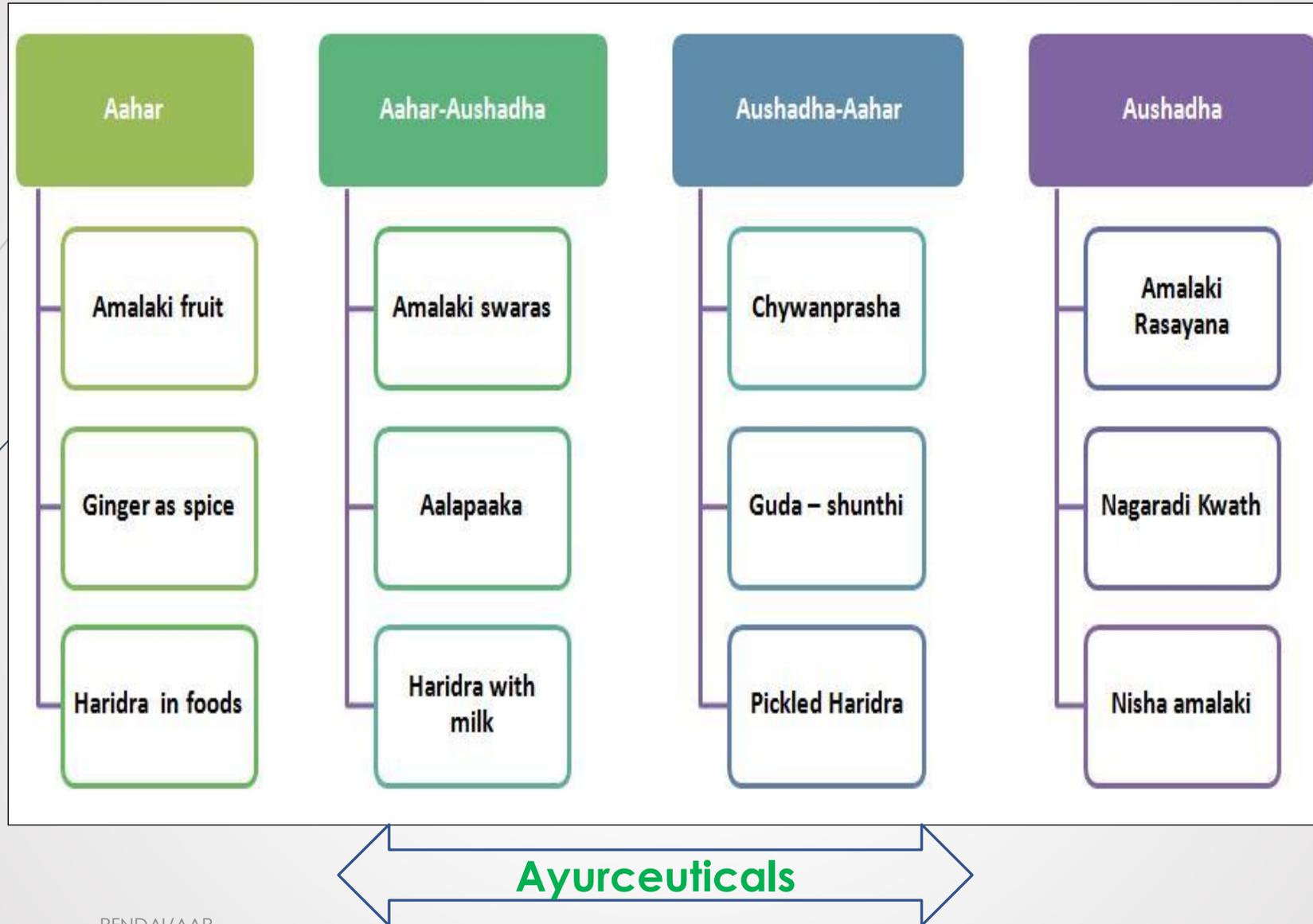
- ❖ Jala Varga (water)
- ❖ Ksheera Varga (Milk & Milk products)
- ❖ Dhanya Varga (Grains)
- ❖ Shimbi Varga (Pulses)
- ❖ Shaak Varga (Vegetables)
- ❖ Mamsa Varga (Meat)
- ❖ Matsya Varga (Fish)
- ❖ Phala Varga (Fruits)
- ❖ Ikshu Varga (Sugarcane & products)
- ❖ Vyanjana Varga (Condiments)
- ❖ Taila Varga (Oils)
- ❖ Madya Varga (Alcoholic beverages)
- ❖ Krutanna Varga (Processed food)

Ayurveda and Health Foods

- ▶ Regulation of diet crucial – whole body and health affected by food
- ▶ Food influences physical, temperamental, and mental states.
- ▶ 1st converted into rasa (plasma), followed by successive conversion into blood, muscle, fat, bone marrow, reproductive elements, and body fluids .
- ▶ Imbalance of mind, body, and spirit result in diseased state
- ▶ *Nidan Parivarjan* treatment mainly considers avoiding of known causative factors for a disease- *Aharatmaka* *Nidana* (dietary), *Viharatmaka* *Nidana* (regimens), *Manas* *Nidana* (psychological), and *Any* *Nidana* (others).

Ayurvedic Ingredients: Usage Flexibility

11



Nutra
epidemiology
(historical &
contemporary)

Human
Observational
Reports (Vaidyas
Notes and
journals/old
magazines,
clinical
phenomena
driven reports)

Experiential
nutra study
(open labelled
human studies,
with routine
investigations
and
semiquantative
scales)

Exploratory study
(in targetted
subset, using
advanced
biomarkers of
assessment with
semiquantitative
scales)

Experimental
study (for
mechanisms of
action)

Source: Namyata Pathak, Hiteshi A Shah, Ashok Vaidya (2015) Clinical Perspective of Ayurceuticals: Challenges and Opportunities for Global Health and Wellness In book: Clinical Aspects of Functional Foods and Nutraceuticals (pp.35-50). CPC Press Taylor and Francis Group

Rasayana



- ▶ Avert the degenerative changes caused by ageing (*Rasayana*),
- ▶ Convalescence after an illness (*Balya*),
- ▶ Enhance the defense system (*Roga Pratibandhaka Rasayana*),
- ▶ Maintain the vigor and vitality (*Vajikarana*),
- ▶ Maintain joie-de-vivre (*Jeevaniya*).
- ▶ Most rasayanas to be consumed in early hours of day



Delivering benefits to a particular organ



- ▶ *Chywanprash* for respiratory system
- ▶ *Pippali rasayan* confer immunity to respiratory system
- ▶ Triphala [powder of fruits of *Terminalia chebulia* (Haritaki), *Terminalia bellirica* (Bibhitaki) and Amla] along with honey and ghee advocated for maintaining/improving eyesight ---

Prevention of rhinitis and respiratory problems in winter:

- ▶ Amla -- based preparation
- ▶ Rose petals and sugar – mild laxative
- ▶ *Ardraka paka* –aid to digestion
- ▶ Bael fruit confection for gastrointestinal problems
- ▶ Grated garlic, fresh ginger, fresh turmeric + lemon and salt—to aid digestion



Horsegram (Kulith)

(*Dolichus biflorous* Linn.)



- ▶ Antiurolithiatic effects due to:
 - ▶ Diuretic effect
 - ▶ Presence of binding proteins
 - ▶ Antioxidants attributable to saponins -amphiphilic nature
 - ▶ ?
 - ▶ Lectins: activity in *yush*- 16HU/g, raw horsegram - 5.33HU/g
 - ▶ --Polyphenols



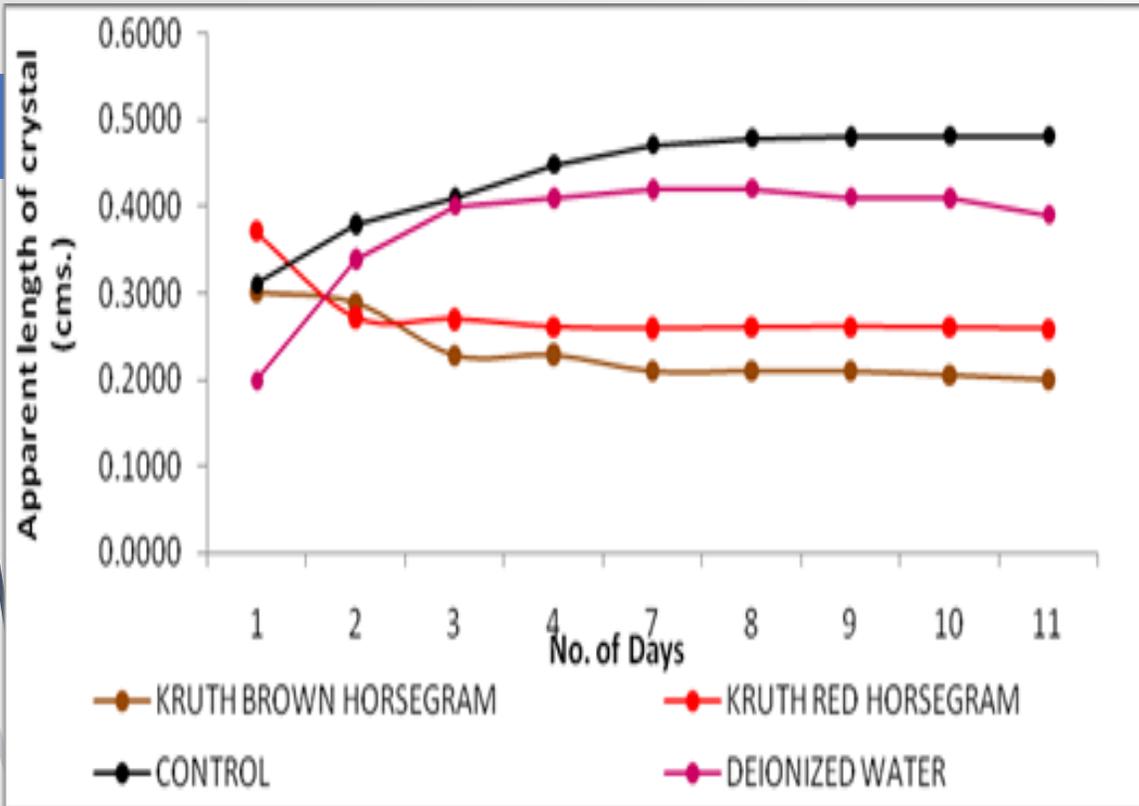


Fig. 1: Growth of Crystals over 11 days in the presence of *Kruth_Yush prepared* from brown and red varieties of horsegram

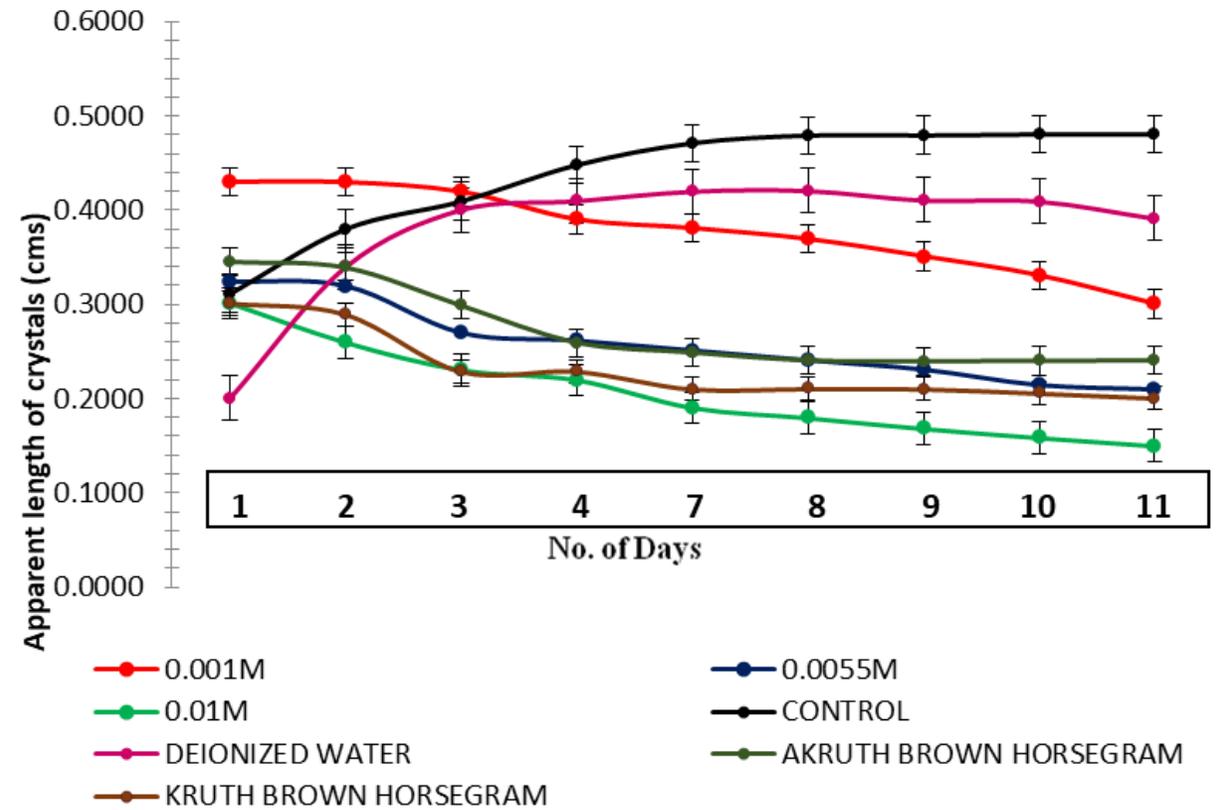
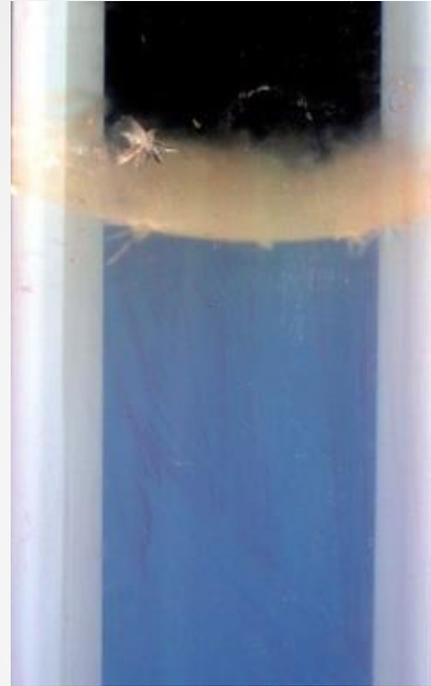


Fig. 3: Growth of Crystals over 11 days in the presence of *Kruth Yush* with salt and trikatu with and without Citric acid compared to Control, Deionized Water, *Akruth* and *Kruth yush* (salt and trikatu only)



Lemon juice- 2.08%

Citric acid- 0.01M

Control

Deionized Water

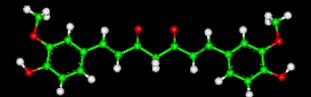
Comparison of crystal growth with control, deionized water, lemon juice and citric acid

Turmeric (Nisha/Haldi) - the Golden spice

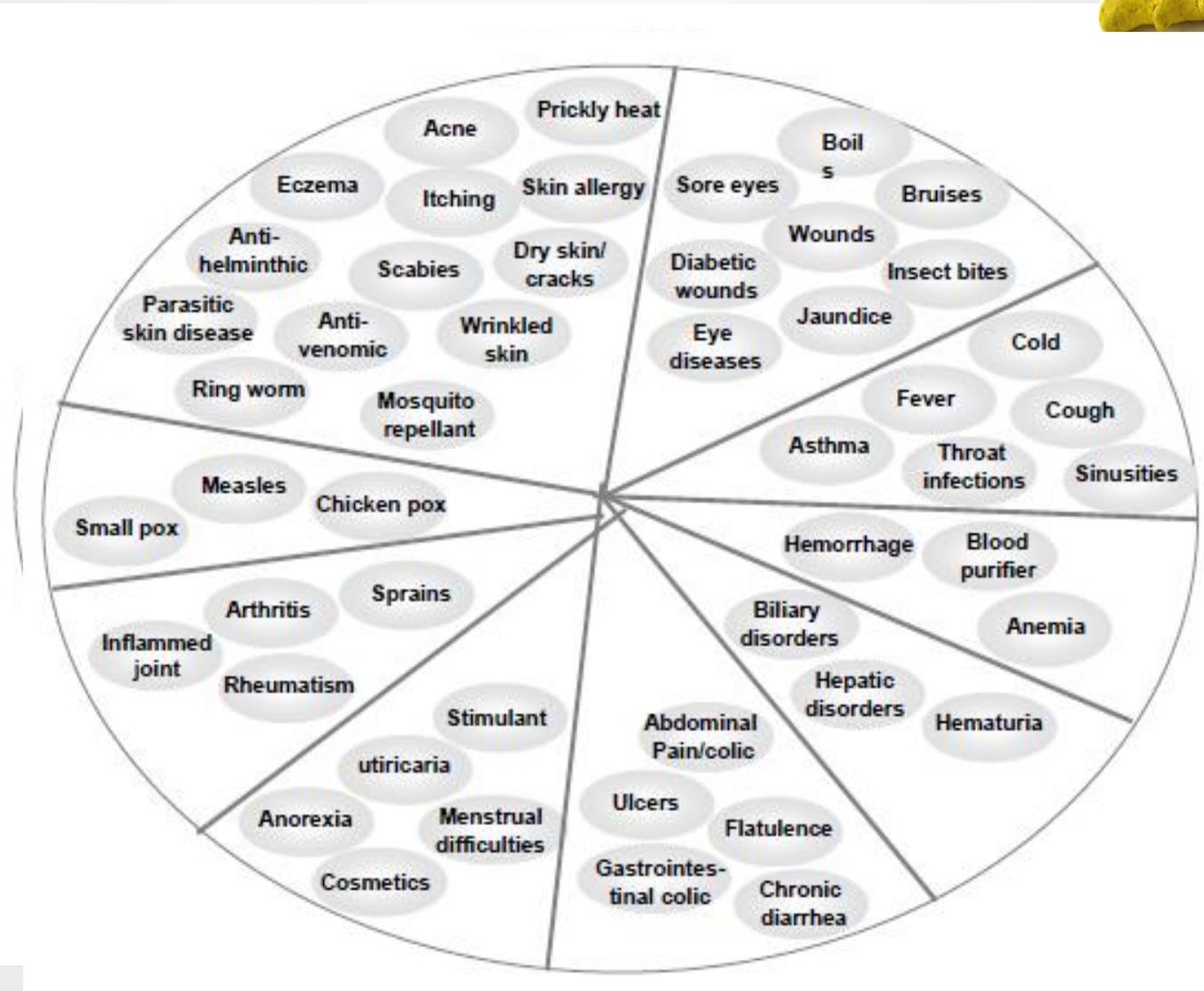
- ▶ Ancient Vedic societies - “the herb of the sun”
- ▶ at least 6000 years of documented use
- ▶ 53 synonyms for turmeric in Sanskrit
- ▶ *Kanchani*, the “Golden Goddess,”
- ▶ “Turmeric the preserver, keeping foods safe in a land of heat and hunger,”
- ▶ “Turmeric the auspicious spice, placed on the heads of newborns for luck, sprinkled over coconuts at *pujas*, rubbed into the borders of wedding saris



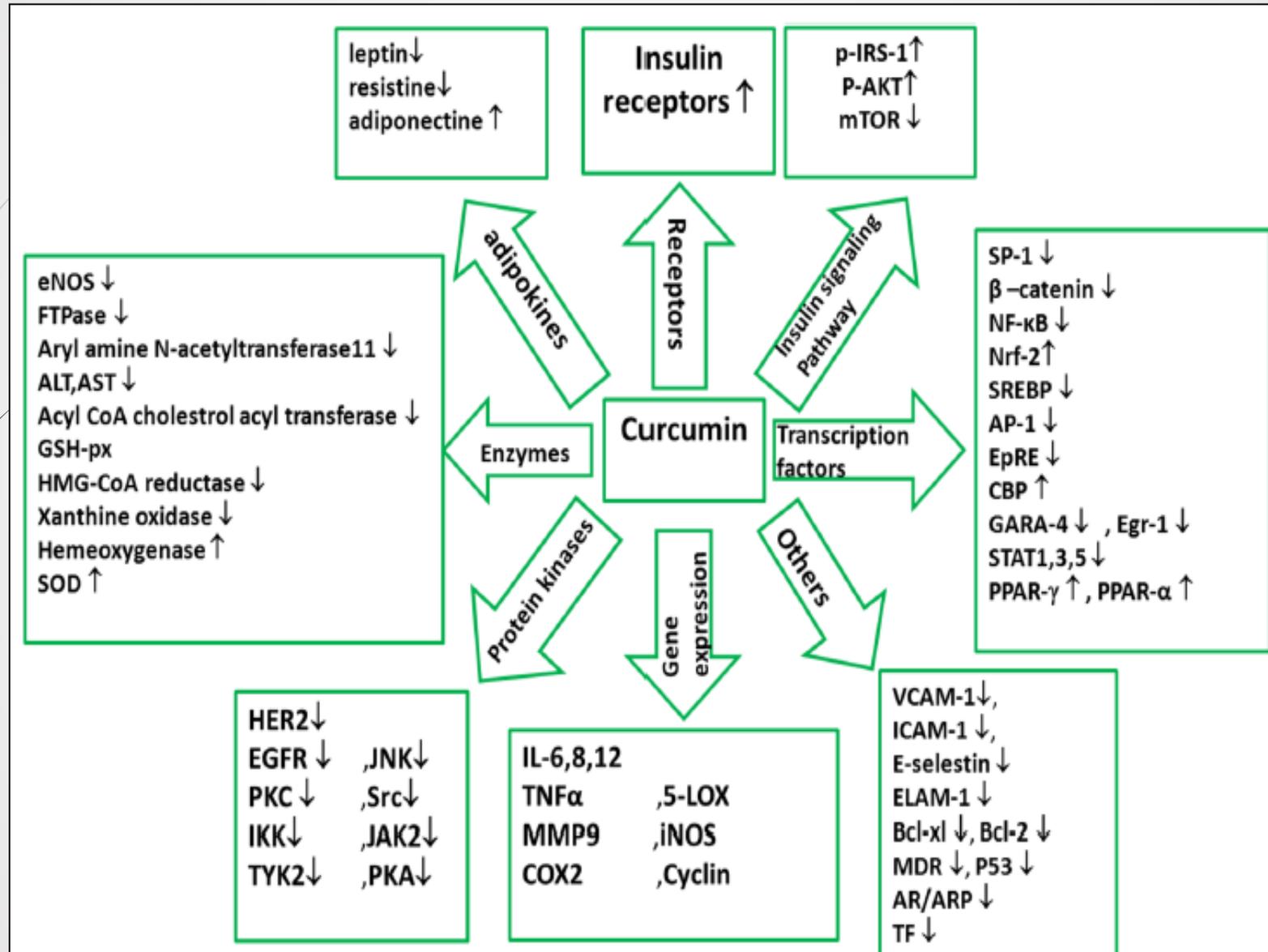
- ▶ Western world: not much interest until 20th century
- ▶ Serious attention – research from early 1920’s in Germany
- ▶ Contains numerous (100s) of molecular constituents, each with a variety of biological activities.
- ▶ ~20 molecules having antibacterial properties
- ▶ 14 -cancer preventives,
- ▶ 12 -anti-tumor,
- ▶ 12 - anti-inflammatory and
- ▶ ~10 with anti-oxidant effect.
- ▶ Whole herb vs isolated molecules??
- ▶ Most research done with curcuminoids (95%) although in the raw state their content is only 3-5%



Curcuma longa: Traditional use



Curcumin: Diverse targets and molecular Mechanisms



Reverse Pharmacology of *C. longa* Linn

Sr.No	Activity	References
1	Anti-mutagenic property of curcumin (<i>in vitro</i> by Ames test)	Bhide et al 1986
2	Reversal of the DNA damage in patients of oral submucous fibrosis.	Hastak et. al 1997
3	Chemopreventive activity in patients of oral sub-mucous fibrosis	Pillai D, 1997.
4	Phase I evaluation of safety and tolerability in healthy volunteers	Joshi et. al 2003
5	Insulin -sensitising and antidiabetic activity	Vaidya et al, CSIR-NMITLI report



CURCUMA LONGA (T. Oil)

Anti-mutagenic Anti-cancer Anti-inflammatory



Dr. Sumati Bhide

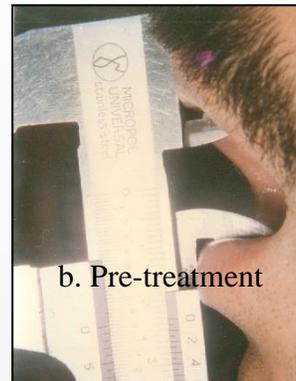
Antimutagenic *in vitro*: Ames test

Anticancer and antiinflammatory in patients SMF

- ▶ After treatment 3 months clinical improvement
- ▶ increase in interincisal opening to various degrees
- ▶ Decreased Micronuclei (Buccal & Peripheral), Increased antioxidants
- ▶ Biochemical parameters remained within normal range after the treatment



a. Patient with SMF

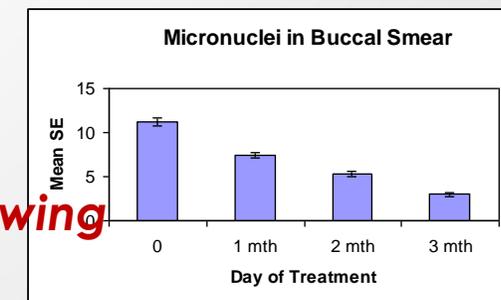


b. Pre-treatment



c. Post-treatment

Angle of mouth measured with Vernier calipers showing increase after treatment with turmeric oil

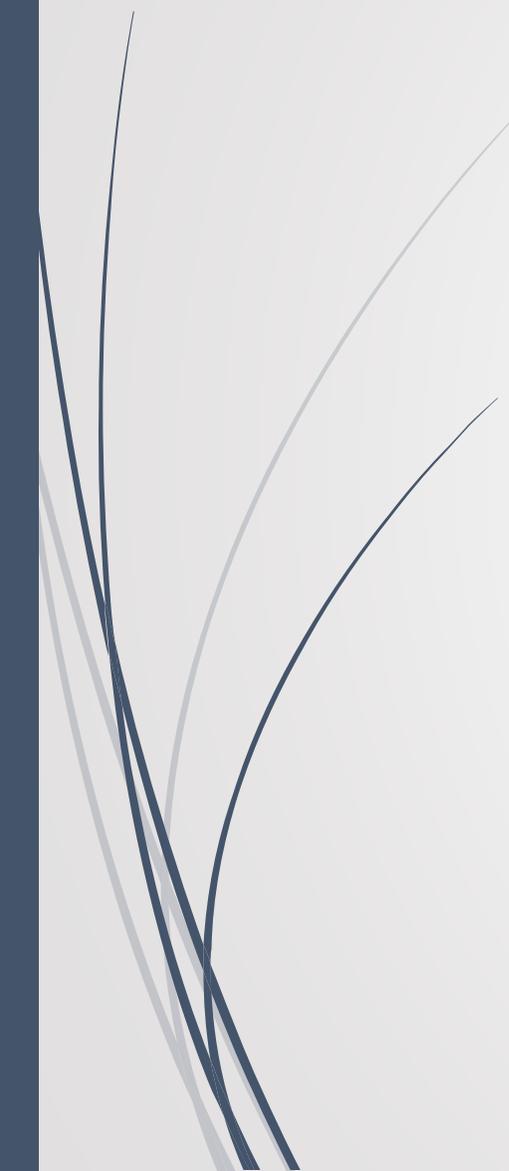




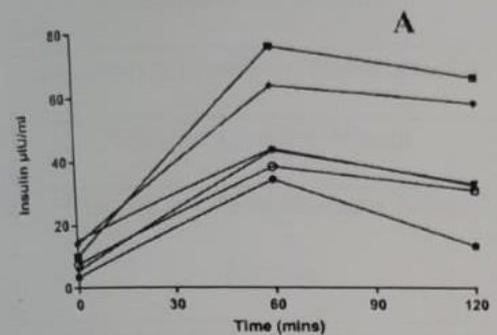
Amlaki rasayana

- Guruprasad et al (2017)
- Rasayana deals with the rejuvenation, regeneration, immunomodulation and healthy ageing, used to improve quality of life in aged individuals
- * Telomerase activity maintains telomere length, implicated in ageing and various diseases-- shortening of telomere during ageing controlled chiefly by telomerase activity.
- * Amalaki Rasayana prepared from Amalaki/ amla; widely used in the Indian traditional system of medicine as a cardiac, cerebral and intestinal tonic.
- * A Vayasthapana rasayana, reported to promote longevity, prevent ill health and block geriatric symptoms.
- * *P. emblica* a good source of ellagic acid, gallic acid, quercetin, kaempferol, emblicanin, flavonoids, glycosides proanthocyanidins and vitamin C
- * 45-60 yrs considered to be age of onset of geriatric symptoms- increased telomerase activity in blood mononuclear cells

- 
- ▶ As rasayana, *Amalaki* found to be effective on:
 - ▶ general health, age related changes, voice, sensory organs, physical capacity, psychological improvement and complexion.
 - ▶ Administration with milk significantly effective against symptoms -insomnia, constipation, digestive weakness
 - ▶ Use (0.5%) as food supplement showed increase in fecundity, size of salivary gland with additional cycles of DNA endo - replication, thermo tolerance, starvation tolerance, median life span, and shortening of developmental time

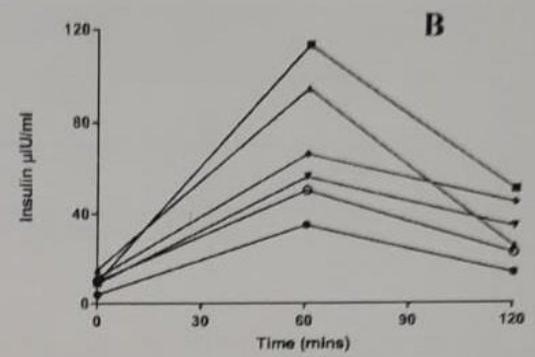


Glucose



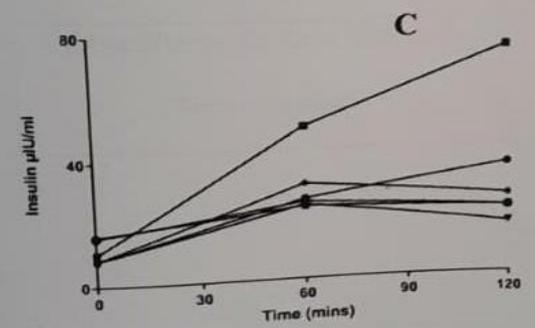
Min	0	60	120
Mean	80.7	106.6	92.5
±SD	12.5	18.5	12.8
%CV	15.5	17.4	13.8
Minimum	59.4	77.9	71.4
Maximum	95.6	125.5	107.7

Glucose + *Nisha Amalaki*



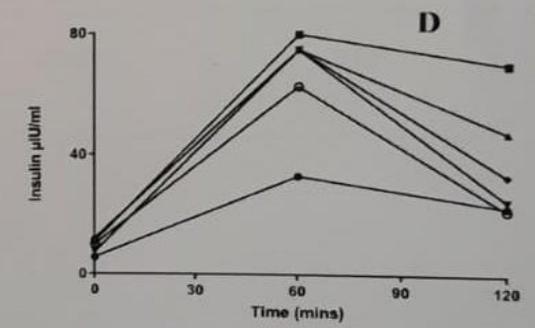
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Rava Sheera



Min	0	60	120
Mean	80.7	106.6	92.5
±SD	12.5	18.5	12.8
%CV	15.5	17.4	13.8
Minimum	59.4	77.9	71.4
Maximum	95.6	125.5	107.7

Rava Sheera + *Nisha Amalaki*



Min	0	60	120
Mean	80.7	106.6	92.5
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%CV	15.5	17.4	13.8
Minimum	59.4	77.9	71.4
Maximum	95.6	125.5	107.7

1 2 3 4 5 6

Fig: Insulin Responses of Volunteers to Various Treatments:
 A) Glucose B) Glucose + *Nisha Amlaki* C) Rava Sheera D) Rava Sheera+*Nisha Amlaki*

Source: Pawar A(2018) Effect of *Nisha Amalaki* on the Glycemic Index and Insulin Response to Rava Sheera . MSc Dissertation submitted to SNTD Women's University

Summary of results of studies on Haridra (DM001) and Amla (DM 002)

DM001

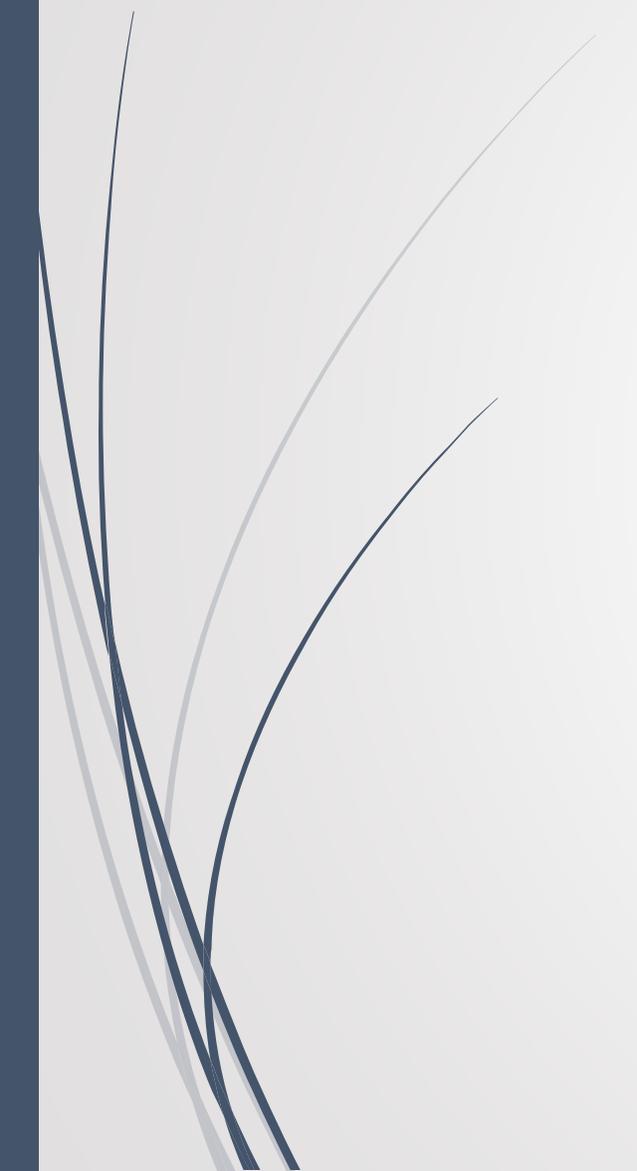
- ✓ Protects against STZ induced damage RIN cells
- ✓ Not mediated *via* MDA
- ✓ Inhibits insulin secretion
- ✓ Reduces angiogenesis
- ✓ Anti-oxidant activity,
- ✓ Anti-aggregatory effects: mediated through curcumin
- ✓ dose dependent inhibition of aldose reductase activity at higher concentration

DM002

- ✓ Protection against STZ induced damage RIN cells
- ✓ Mediated through ↓ in MDA
- ✓ Increased insulin secretion at
- ✓ Stimulates angiogenesis
- ✓ increased glucose uptake
- ✓ AKT phosphorylation,
- ✓ GLUT4 translocation)
- ✓ Gallic acid active, not ellagic acid



DM-FN-01 (Nisha Amalaki)

- Insulin sensitisation: *in vitro* & *in vivo*
 - Inhibition of protein glycation *in vitro*
 - Antioxidant and antiinflammatory
 - Antimutagenic and DNA protection
 - Tablets do not interact with metformin
 - Most widely used-unstandardised
- 

Sunthi

Table 3: Number of Patients experiencing various symptoms at Baseline and Days 7 and 14 after intervention.

Symptom	Sunthi group		Trikatu group	
	Baseline (n=15)	Day 7 (n=15)	Baseline (n=17)	Day 7 (n=17)
Score (Mean± SD)	12.7±3.9	7.8±3.2	12.6±2.9	10.3±3.8
Min-Max	4-19	1-14	8-19	8-17
Morning Stiffness				
Severe	4	0	8	3
Moderate	10	12	9	10
Mild	1	3	0	4
Pain on rest				
Severe	6	0	7	6
Moderate	5	5	9	8
Mild	4	10	1	5
Gastrointestinal upsets				
Severe	7	0	9	2
Moderate	5	8	7	4
Mild	3	7	1	11
Dysuria (Burning sensation during urination)				
Severe	0	0	1	1
Moderate	2	3	0	2
Mild	1	5	4	5
Blood in stools				
Occasionally	1	2	5	0
Frequently	0	0	1	0
Regularly	1	0	0	0
Fever				
Severe	4	4	4	5
Moderate	7	9	7	7
Mild	3	1	6	4

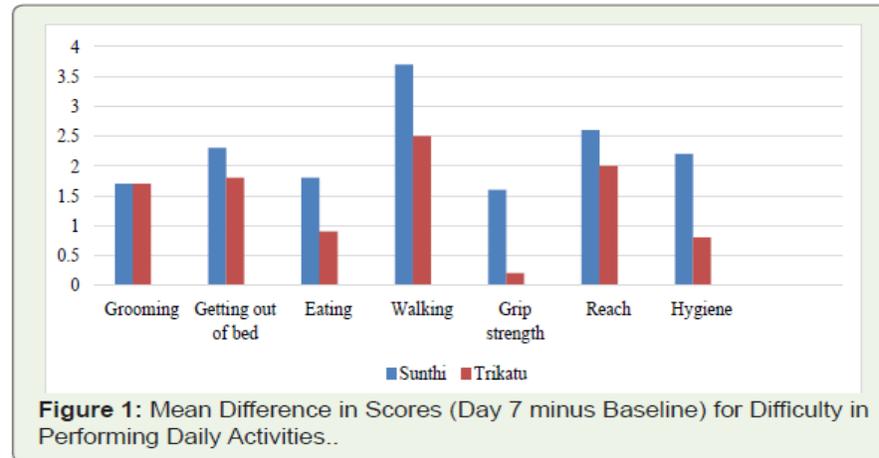


Figure 1: Mean Difference in Scores (Day 7 minus Baseline) for Difficulty in Performing Daily Activities..



Figure 2: Mean Improvement in Grip Strength.



was a reduction in symptoms from Day 0 to Days 7 and 14 of

Table 4: Mean decrease in Ritchie's Articular Index for Right and Left sides (Baseline minus Day 7 scores).

	Sunthi (n=15)		Trikatu (n=17)	
Pain	-4.0±1.1	-5.0±1.9	-3.2±3.1	-3.8±2.4
Swelling	-3.4±2.6	-2.6±3.7	-3.3±3.6	-3.4±3.8
Warmth	-3.8±1.6	-3.9±2.0	-3.4±3.3	-3.6±2.0
Limitation of motion	-3.6±1.0	-4.0±1.1	-3.1±3.4	-3.0±1.9

Deo K, Pendse N, Udipi SA. (2022) Management of Amavata/Rheumatoid Arthritis with Langhan (Fasting), Sunthi (dried ginger) and Trikatu- an Ayurvedic Polyherbal formulation.

Honey / Madhu

Produced by *Apis mellifera* L.

- Ayurveda, used for internal and external applications.
- Mainly for treatment of eye diseases, cough, thirst, phlegm, hiccups, blood in vomit, leprosy, diabetes, obesity, worm infestation, vomiting, asthma, diarrhoea and healing wounds.
- Useful in Hyperlipidemia
- Navin Madhu acts as laxative.
- Healing property: Due to Shodhana (purification), Ropana (healing), and Sandhana (union) properties it is useful for topical application on wounds and mouth ulcers.
- Ayurveda mentions Yogavahi properties of Madhu i.e. when honey is used with other herbal preparations it enhances the medicinal qualities of those preparations and also helps them to circulate in whole body.

Antioxidant, antimicrobial, nematicidal, antifungal, anticancer, and anti-inflammatory activities.

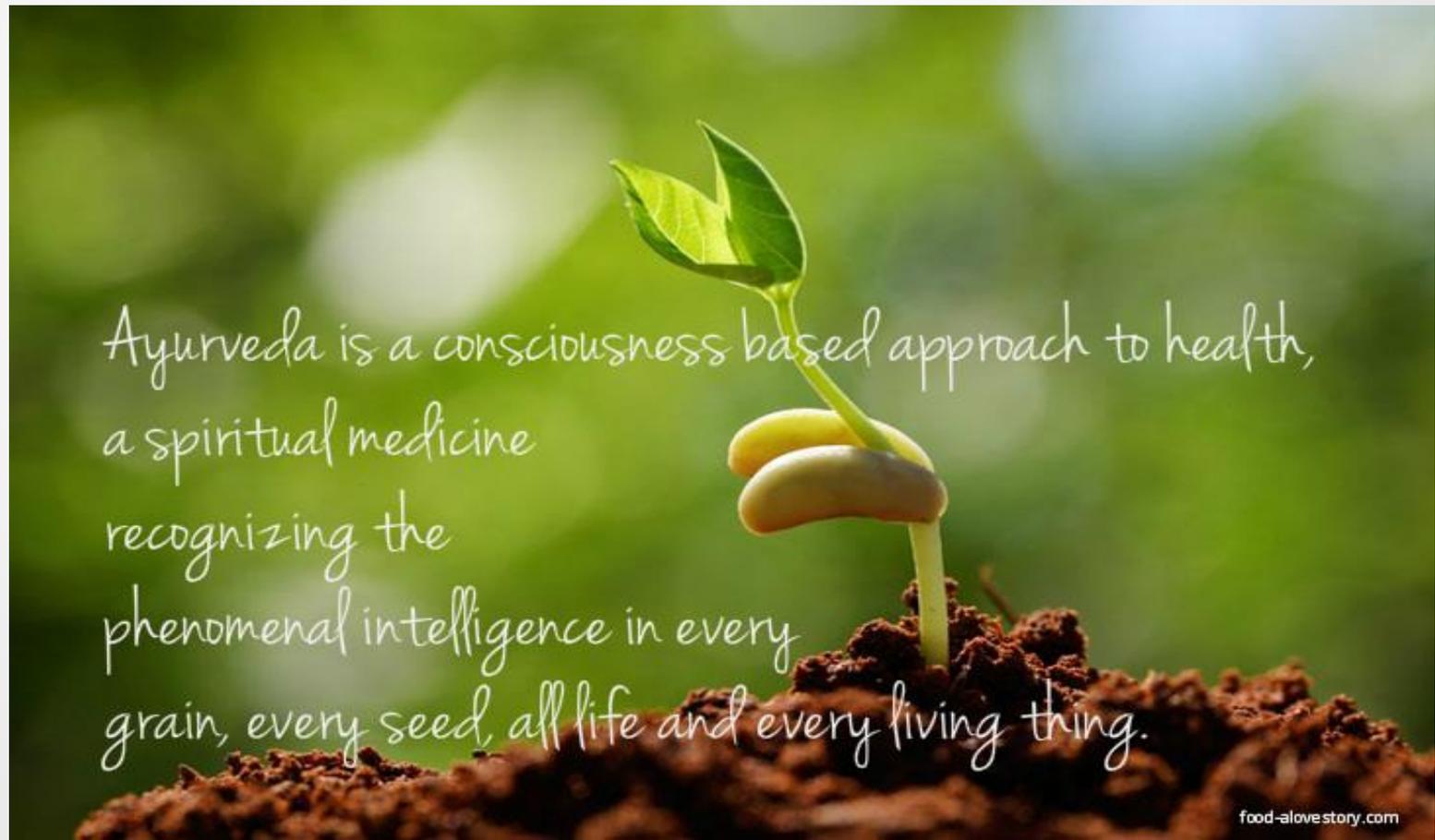


Sharma K, Goyal C, Prajapati D (2015)
International Journal of Ayurveda and
Pharma Research 3(9)

- Composition: highly varies, depend on type, flowers, pollen that bees collect
- > 180 components– Fructose (38%), glucose (31%) disaccharides- maltose, sucrose, maltulose, turanose etc
- Vitamins (riboflavin, niacin, folic acid, pantothenic acid, vitamin B6, ascorbic acid)
- Minerals (Ca, Fe, Zn, K, P)
- Organic acids: (citric, succinic, lactic, malic and gluconic acid)
- Amino acids, proteins,
- Enzymes (glucose oxidase, sucrose diastase, catalase and acid phosphatase)
- Polyphenols, (86 to 1141 mg kg⁻¹) mostly flavonoids and phenolic acids: antioxidant capacity, medicinal properties
- Flavonoids : flavonols (myricetin, kaempferol, 8-methoxy kaempferol, quercetin,isorhamnetin, quercetin-3-methyl ether, quercetin 3, 7-dimethyl ether, pinobanksin, rutin and galangin),
- flavons (genkwanin, luteolin, apigenin, tricetin and chrysin) and flavanones (pinocembrin and pinostrobin).
- Phenolic acids :hydroxybenzoic acids (methyl syringate, gallic acid, ellagic acid, protocatechuic acid, syringic acid,benzoic acid, 4-hydroxybenzoic acid), hydroxycinnamic acids (chlorogenic, vanillic, caffeic,p-coumaric, ferulic acids) and hydroxyphenylacetic acids (homogentisic and phenylacetic acids)
- Prevent oxidative stress, antioxidant capacity -- dark honeys > light-color honeys
- **DPPH** (: upto 0.16-356)



THANK YOU



Ayurveda is a consciousness based approach to health,
a spiritual medicine
recognizing the
phenomenal intelligence in every
grain, every seed, all life and every living thing.