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Biochemistry in Āyurveda- A Review

Author - Dr. Deepa A. A., (Assist. Prof.)
Dept. of Basic Principles of Āyurveda, College of Āyurveda, Bharati Vidyapeeth University, Pune, Maharashtra, India.

I. Introduction:

Āyurveda has its own specific biochemical approach towards fundamental elements of Universe. Absolute knowledge of evolutionary matter cannot be completing through visual perceptive method but can only be implicated. Contemporary science is based on laws of Physics and chemical reactions of the component. As per modern discipline of physics and chemistry, *physical and chemical properties* are characteristic as per its electron configuration. Law of thermodynamics, law of redox reaction, laws of Acid-base reactions is based on analogous Quantum theory. A redox reaction is based on electron affinity of two compounds. Oxidations reactions are elevating free radicals produced by Oxidizing agents. Antioxidants are often relegating free radicals by reducing agents. Acid Base reactions also are explained on Hydrogen ion or on electron donor-acceptor formula. Thus, in modern science, electron configuration of the element forms foundation.

Āyurveda deals these aspects on the principles of Vaiśeshika philosophy of Padārtha and on the basis of Panca-Mahābhuta. Āyurveda explains biochemical process based essentially on **Guṇa Theory** that follows principle of Sāmānya- Viśeṣa. Āyurveda has emphasis on Panca-Mahābhuta as fundamental elements that can only be inferred in all the universal elements. Pancabhautika structures are established on foundation of Guṇa (attribute). **Guṇa (attribute)** is factor inherently associated vice versa with compound which is based on its Pancabhautika structure. Balance (equilibrium) of energy and function in an entity is to be balanced through elevating (Sāmānya) and relegating (Viśeṣa) of Guṇa (Attributes).

II. Methodology:

In Āyurveda, the reaction between the two compounds is based on Guṇa Semblance. Combination of the vital elements (Panca-Mahābhuta) also follows the natural processes through coupling of Sāmānya- Viśeṣa. Guṇa shows approximately relevance with modern biochemical process of reactions. Pancabhautika structures are established on foundation of Guṇa (attribute). Ancient Indian Philosophies approved this theory to explore the process of Evolution. As an ancient science, Āyurveda also followed the theory of Guṇa to explicate its medical significance.

There are many terms used regarding applicability of this principle exploring various aspects of it like Sāmānya- Viśeṣa. But it never occurs exclusively, as a rule of Nature, increased in one factor leads to reduction of other opposite element as seen in Redox Reaction. It can also be stated as amplification of any one factor causes decrease of other reverse factor. It is mostly followed by all biological cycles. Panca-Mahābhuta works in synergy/conjoint form in all the matters. Configuration of Panca-Mahābhuta alters physical and chemical properties in matter and in species too, that leads to numerous structures eventually leads to change in permutation of properties. Therefore, specification of each Mahābhuta based on Guṇa has been described to expedite it in anatomical, physiological and medicinal aspect. Furthermore, addition of similar configuration leads to Sāmānya (Gain) whereas addition of dissimilar composition leads to Viśeṣa (loss)**.** Gain or loss in this reaction is net productivity obtained leading to increase or decrease in attributable level in entire compound. In Āyurveda, the increase or decrease level of attributes is interpreted with imbalance in an aggregate proportion of body elements. Genomic value of each individual plays important role for baseline values of proportion of body elements in each individual. It indicates particular natural dominant level of Guṇa in that individual. Change in these levels leads to imbalance with explicit module along with common characteristics. Thus, Attribute defines chemical as well as physical properties of substance. Subsequently in ancient period assessment of physical attributes was based on perception by five senses (touch, sound, appearance, taste, smell). Whereas chemical attributes were explored through its *capacity to perform precise effect* in the matter by elevating or reducing the form. The Sāmānya- Viśeṣa (to elevate or reduce) at the end results in Santarpana- Apatarpana (Promote-Supress) respectively. Sāmānya denotes increased (gaining) level of any constituent; it also has effect of Santarpana like Bṛuhana, Snehana, Sthambhana, Kledana are various manifestations.

Panca-Mahābhuta are classified mainly into two groups: *Guru and Laghu* ***or*** *Sheeta and Ushna*. Mostly basically dietary items are classified as Guru or Laghu (related with Rasa i.e. tastes) ≈ Digestibility, Absorption, Solubility, Density, Permeability and medicinal substances as Sheeta and Ushna (related with Virya) ≈ ph., oxidising- reducing action, osmosis, diffusion, transformation. It is generally accepted in all Samāna-Pratyārabdha substances i.e. in composition having basic constituents with analogous Guṇa. As seen in

combinations like Snigdha + Guru, Snigdha + Sheeta, Snigdha + Manda, Snigdha + Sāndra/ Drava **OR** Ruksha + Laghu, Ruksha + Ushna. Whereas the Vichitra- Pratyārabdha substances i.e. in composition having basic constituents with divergent Guṇa. Vichitra- Pratyārabdha substances show characteristics on the basis of dominant basic elements in its composition as like Snigdha + Ushna, Snigdha + Tikshna **OR** Ruksha + Sheeta, Ruksha + Guru **OR** Sāndra/ Drava + Tikshna. Analogous or divergent Guṇa composition in substance is an important aspect of biochemical analysis in Āyurveda. Similar in Redox or acid-base reactionby elevating (accept) or reducing (donate) form.

The endpoint of all reactions likewise redox reaction, as per Āyurveda are classified into two groups: a) Santarpana- Capacity to undergo binding (accept) which manifest in over / hyper sort as weight gain (Bruhana), hyperlipidaemia (Snehana),obstruction (Avarodha / Sthambhana), aggregation (Upalepa), various types of hypertrophy and b) Apatarpana- Capacity to undergo reducing (donate) which apparent leads to loss in weight (Langhana), loss of lubrication / emollient (Rukshana), loss of sweat (Swedana), all sorts of conditions with decreasing level of nutrient.Major systemic diseases often occur due to change in Guṇa of Rasa-Rakta Dhātu (body elements) for e.g. Tikshna Guṇa (pungent action) leads to infiltrate action causing alteration in Rasa-Rakta Dhātu (Body fluid, Blood).

Fundamental attributes in Human body eventually in medicine are Gurvādi Guṇa that are also known as Sharira Guṇa/ Karmanya Guṇa. They are in paired form present in inversely proportion to each other in a single Compound. Hence are leading to Santarpana and Apatarpana. Attributes are defined as capacity to perform precise action in body. These actions are seen in normal level of attributes.

Santarpana causing Attributes: 1) Guru (creates Heaviness in Body) 2) Manda (slow down actions in body elements having mobility) 3) Hima (creates restraints in body elements) 4) Snigdha(creates moistening/ lubrication) 5) Slakshana (restoration) 6) Sandra (normality of elements) 7) Mrudu (slacken) 8)Sthira (steadiness/ stabilise) 9) Sthula (to obstruct) 10) Picchila (smearing/adhesive act)

Apatarpana causing Attributes:1) Laghu (lightness/ easy to digest) 2) Tikshna (to eliminate/ detach) 3) Ushna (to perspire) 4) Ruksha (to absorb) 5) Khara (to remove) 6) Drava(to dissolve/solvent) 7) Kathina (to create firmness) 8) Sara/Chala(to move) 9) Sukshma (to be accessible/enter) 10) Vishada (to immaculate).

Among these 10 pairs, eight Attributes i.e. Sheeta, Ushna, Guru, Laghu, Snigdha, Ruksha, Mrudu, Tikshna are dominant vital potencies of medicines.These attributes state composition of body elements from cell level to organ level.For example, Liver as well as Pancreas show Teja-Mahābhuta dominant composition in cells indicated through its physiology that specify its prevalence of Ushna, Tikshna, Ruksha, Suskshma, Laghu attributes in varied quotient. It has to determine by its role in body functions.

The above10 pairs of attributes are needed to be visualised in modern science to explore more aspects of materialistic substances. So that it can be applicable to all the basic disciplines. Besides these Guṇa, other Guṇa like Rasa (tastes) and Vipāka (end product of food digestion) too are mostly coherently associated with Gurvādi Guṇa mostly with Guru/Laghu, Snigdha/ Ruksha and Sheeta/ Ushna.

With this point of view a project was carried out to validate the biochemical analytical parameters regarding Snigdha-Ruksha Guna.This subject is rarely studied to find out precise biochemical mechanism of the interrelation between food and their Guṇas (attribute) in laboratory. It was though a minor pilot study of bridging process that needs to be done in enormous way. Clinical and animal experimental studies are carried out on Guṇa but laboratory studies needs to be emphasised to postulate biochemistry behind it.

The study of 22 dietary item mainly rice, cereals cited by most recommended Āyurvedic literature is located through biochemical assays. Food samples of Snigdha – Ruksha Guṇas mentioned by Caraka Saṃhitā were taken for biochemical analysis.Samples from dietary items of Snigdha –Ruksha Guṇa mentioned by Saṃhitā was taken for biochemical analysis. Samples were obtained from Āyurvedic practitioner and also from market yard, Pune.

. **Sr.no**	**Scientific name**	**Common name**	**Snigdha/Ruksha**
1	OryzaSativa	Shashtishali	Snigdha
2	OryzaSativa	Shashtishali (Roasted)	Ruksha
3	HordeumVulgare	Yava	Ruksha
4	HordeumVulgare	Yava (Roasted)	Ruksha
5	OryzaSativa	Raktashali	Snigdha
6	OryzaSativa	Raktashali (Roasted)	Ruksha
7	OryzaSativa	Basmati	Snigdha
8	OryzaSativa	Basmati (Roasted)	Ruksha
9	OryzaSativa	Kolam	Snigdha
10	OryzaSativa	Kolam (Roasted)	Ruksha
11	OryzaSativa	Ambemohar	Snigdha
12	OryzaSativa	Ambemohar (Roasted)	Ruksha
13	PhaseousAureus	Mudga	Ruksha
14	Linum Ustitatissmum	Jawas	Snigdha
15	Sessamum Indicum	Teela	Snigdha
16	Triticum Sativa	Godhum	Snigdha
17	Sorghum Vulgare	Jawar	Ruksha

18	Cajanus Indicus	Chana	Ruksha
19	Eleusine coracana	Nachani	Ruksha
20	PhaseolusMungo	Udeed	Snigdha
21	Oryza Sativa	Normal rice	Snigdha
22	Oryza Sativa	Normal rice (Roasted)	Ruksha

To study the effect of roasting of food samples six rice varieties were taken (Shashtishali, Raktashali, Basmati, Ambemohar, Kolam and local rice) and the raw and roasted forms were used for analysis. The samples were collected and powdered with a mechanical grinder and stored in air-tight containers. Objectives of this work was -1) to associate the food properties(attribute) in terms of with their known type of Snigdha and Ruksha Guṇa and correlate its binding/ moisten (Kledana) and absorption (Shoshana) or Lekhana (scavenging) process respectively with antioxidant potential and macronutrient bioavailability and 2) to evaluate the influence of roasting on this association. To achieve this, redox reaction is key process used for biochemistry to analyze oxidant and antioxidants. Assessment of capacity to binding, moistening (Kledana), absorption (Shoshana) and scavenging (Lekhana) process according to Āyurved were needed to be validating through biochemistry. Though multiple biochemical analytical parameters can be implemented, here only simple accessible criteria were applied. To assess scavenging (Lekhana) and binding (Bandhakrut) capacity, antioxidant potential of food extracts was assessed by seven in vitro methods and capacity of extracts to prevent H_2O_2 induced erythrocyte oxidative damage by estimating four cellular antioxidant parameters. By using an in vitro digestion method; fat, carbohydrate and protein absorption (Shoshana) was estimated.

III. Discussion:

Results indicated that Ruksha samples have higher antioxidant potential and can better protect the erythrocytes from oxidative damage with more protein and triglyceride absorption as compare to Snigdha samples. In the comparison of raw and roasted rice samples, erythrocyte protection was superior in raw samples with enhanced triglyceride and carbohydrate intestinal absorption. These results clearly indicate the differential behavior of Ruksha and Snigdha samples at antioxidant, erythrocyte and intestinal absorption levels.

It determined as Ruksha samples have higher antioxidant potential (reduces obstructive damage) and can better protect the erythrocytes from oxidative damage as compare to Snigdha samples. At the level of intestinal bio accessibility, protein and triglyceride in Ruksha samples were more absorbed (shows Laghu Guṇa invariable associated with Ruksha Guṇa) than the Snigdha samples. In the comparison of raw and roasted types of rice samples, though the roasted forms demonstrated slightly higher antioxidant potential but erythrocyte protection was superior in raw samples with enhanced triglyceride and carbohydrate intestinal absorption. These results clearly indicate the differential behaviour of Ruksha and Snigdha samples at antioxidant, erythrocyte and intestinal absorption levels. This signifies that by using different biochemical analysis we can distinguish the Ruksha and Snigdha properties of samples. Ruksha attribute is foremost cause for increased level imbalance of Vāta and Snigdha attribute is prime cause for increased level imbalance of Kapha-Pitta functional component. Further studies at micronutrients levels with clinical interpretation are also needed to be carried forward. However for complete interpretations of this study it needs to be conducted in extensive manner to achieve consistent in it. Further work with this approach is still in progress.

A substance with anti-oxidative activity is likely to be one that is itself readily oxidized and also prevention of the process of lipid peroxidation led to the identification of antioxidants as reducing agents that prevent oxidative reactions, often by scavenging reactive oxygen species before they can damage cells. These actions of chemical reactions are essentially to be used as a tool to assess Guṇa. Biochemical analysis needs to be asserted in terms of Guṇa. So that it can be applied as a Parameter.

IV. Interpretation:

Āyurveda expounds the three fundamental functional constituents of Universe viz. Soma-Surya-Anila. Among these, Anila (motion) has Ruksha Guṇa is dynamic energy source although it works in conjugation with Soma (saturate) –Surya (scorching) having Snigdha Guṇa. Soma and Surya denotes strong (Tikshna) and weak (Manda) strength of element. It can be assessed with the help of ph. Values, Redox Reactions of substance. The Attributes play essential role in transformation of the three fundamental functional constituents.These Attributes are vital marker for relevance of **Sãmãnya- Viśeṣa,** Santarpana-Apatarpana in Āyurveda.

This type of integrative knowledge will also benefit to all the faculties of science. Bridging will not only help to understand redox reaction in form of Oxidants (oxidative stress) and antioxidants (delay or inhibit the oxidation of biomolecules) in Āyurvedic perspective but also will help to explore periodic table in Āyurvedic aspects. As per principles of Āyurveda, these basic elements are also composed of Panca-mahābhuta. Metabolism pathways established by Āyurveda as perception of Agni (Teja-Mahābhuta) would also help to prevent and cure metabolic disorders. Sāmānya- Viśeṣa is also pragmatic through the **theory of Guṇa** (attribute defined absolutely on its reaction).Thus, in Āyurveda, reactions are representing in mode of Guṇa.

At the end, Matter remains same in Universe only aspects are different. And when they will converge, it will defiantly make world health status better.

References:

[1]. Agnivesa, 'CharakSamhita', revised by Caraka and Drudhabala with 'Āyurvedaa Dipika' commentary, by Cakrapanidatta, edited by Vaidya JadavajiTrikamaji Acharya ,chaukhambasurbhartiprakashan,GopalMandir Lane, Varanasi-221 001, (india), reprint 1984, su.1/49, su.1/59-60, su.25/36,su26/40-42,su.26/64, su.27/10, su.27/13, su.27/19, su.27/21, su.27/23-24, su.27/28-29, sha.1/24,29-30

[2]. Mishra L C in Scientific basis for Āyurvedaic therapies, CRC Press, Florida, USA, 2004.

[3]. Susruta, 'SusrutaSamhita' with 'NibandhaSangrha 'commentary by Dallhanacharya, edited by Vaidya JadavajiTrikamaji Acharya and Narayana Rama Aachrya, ,eigth edition, ChaukhambaOrientalia, post box. no. 1032, Gopal MandirLane,Varanasi -221 001, (India)2005, Sutra Sthana 1/49 Dalhana, p. 12

[4]. AshtangHridaya with ĀyurvedaRasayana commentary by Hemadri , edited by VaidyHaishastriParadkar, ChaukhambhaOrientalia, Varanasi, seventh edition, 1982, su.1/18, Su.1/10-12.

[5]. Parada J, Aguilera JM, Food microstructure affects the bioavailability of several nutrients, Journal of Food Science, 72(2) (2007) R21–R32.

[6]. Moreda-Pineiro J, Moscoso-Perez C, Lopez-Mahia P, Muniategui-Lorenzo S & Prada-Rodriguez D et. al., In-vivo and in-vitro testing to assess the bioaccessibility and the bioavailability of arsenic, selenium and mercury species in food samples, Trends in Analytical Chemistry, 30 (2011) 324–345.

[7]. Gey KF, The antioxidant hypothesis of cardiovascular disease: epidemiology and mechanisms, Biochemical Society Transactions, 18 (1990) 1041–1045.

[8]. Gey KF, Puska P, Jordan P & Moser UK, Total antioxidant capacity of plant foods. Inverse correlation between plasma vitamin E and mortality from ischemic heart disease in cross-cultural epidemiology, American Journal of Clinical Nutrition, 53 (1991) 326S–334S.

[9]. Oki T, Masuda M, Kobayashi M, Nishiba Y&Furuta S, et al, Polymeric procyanidins as radical-scavenging components in red-hulled rice, Journal of Agricultural Food Chemistry, 50 (2002) 7524-7529.

[10]. Lim YY &Quah EPL, Antioxidativetyrosinase inhibiting and antibacterial activities of leaf extracts from medicinal ferns, Food Chemistry, 103 (2007) 734-740.

[11]. Brand–Willams W, Cuvelier M &Berset C, Use of a free radical method to evaluate antioxidant activity, Lebensmittel-Wissenschaft&Technologie, 28 (1985) 25-30.

[12]. Re R, Pellegrini N, Proteggente A, Pannala A & Yang M, Antioxidant activity applying and improved ABTS radical cationdecolorization assay, Free Radical Biology and Medicine, 26 (1999) 1231-1237.

[13]. Garratt DC, The quantitative analysis of drugs, 3rd ed. Chapman and Hall Ltd. Tokyo, Japan. 3(1964): 456-458

[14]. Ruch RJ, Cheng S &Klaunig JE, Prevention of cytotoxicity and inhibition of intercellular communication by antioxidant catechins isolated from Chinese green tea, Carcinogenesis, 10 (1989) 1003-1008.

[15]. Ohkowa M, Ohisi N & Yagi K, Assay for lipid peroxides in animal tissue by thiobarbituric acid reaction, Analytical Biochemistry, 95 (1979) 351-358.

[16]. Oyaizu M, Studies on products of browning reaction: Antioxidative activity of product of browning reaction prepared from glucosamine, Japanese Journal of Nutrition, 44 (1986) 307–315.

[17]. Tedesco I, Russo M, Russo P, Lacomino G G& Russo G L, et al, Antioxidant effect of red wine polyphenols on red blood cells, Journal of Nutritional Biochemistry, 11(2000) 114–119.

[18]. Ellman GC, Tissue Sulfhydryl groups, Archives of Biochemistry and Biophysics, 82 (1959) 70 – 77.

[19]. Aebi H, Catalase in vitro in: packer, L, eds., Methods enzymol New York: Academic press 105 (1984) 121-126.

[20]. Benzie IF & Strain JJ, The ferric reducing ability of plasma (FRAP) as a measure of "antioxidant power": The FRAP Assay, Analytical Biochemistry, 239 (1996) 70–76.

[21]. Placer ZA, Cushman LL & Johnson BC, Estimation of product of lipid peroxidation (malonyldialdehyde) in biochemical systems. Analytical Biochemistry, 16(2) (1966) 359-364.

[22]. Jacobs NJ &Vandemark PJ, The purification and properties of the alpha-glycerophosphate-oxidizing enzyme of Streptococcus faecalis 10C1, Archives of Biochemistry and Biophysics, 88 (1960) 250–255

[23]. Chiplonkar SA, Agte VV, Tarwadi KV &Kavadia R. In vitro dialysability using meal approach as an index for Zn and Fe absorption in humans, Biological Trace Element Research 67(3) 249-256.

[24]. Silvan JM, Assar SH, Srey C, del castilo MD & Ames JM, Control of mailard reaction by ferulic acid, Food chemistry, 128 (1) (2011) 208-213

[25]. Mishra S, Dwivedi RR & RavishankarB, Conceptual and applied study of Snigdha and Ruksha Guṇa with special reference to Rasa-raktagataSneha (hyperlipidemia), Ayu, 32 (2011) 200-206

[26]. RashmiTupe, Dr. Mrs. Deepa Anserwadekar, Pratik Belambe, DhirajkumarAhire, A biochemical approach to understand the concept of Snigdha-RukshaGuṇa. (Under publication in the Indian Journal of Traditional Knowledge (IJTK).