Biochemistry in Āyurveda- A Review

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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 Vaisheshika philosophy of Padārtha and on the basis of Panca-Mahābhuta. Āyurveda explains biochemical process based essentially on Guṇa Theory that follows principle of Sāmānyā- Višeṣa. 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 (Sāmānyā) and relegating (Višeṣa) 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 Sāmānyā- Višeṣa. 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 Sāmānyā- Višeṣa. 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 Sāmānyā (Gain) whereas addition of dissimilar composition leads to Višeṣa (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 Sāmānyā- Višeṣa (to elevate or reduce) at the end results in Santarpana- Apatarpana (Promote-Supress) respectively. Sāmānyā denotes increased (gaining) level of any constituent; it also has effect of Santarpana like Bṛuhana, Snehana, Śthambhana. 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-Pratyrabdh 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 reaction by 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 / Shthambhana), aggregation (Upalpa), 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 due to change in Guṇa of Rasa-Rakta Dāttu (body elements) for e.g. Tikshna Guṇa (pungent action) leads to infiltrate action causing alteration in Rasa-Rakta Dāttu (Body fluid, Blood).

Fundamental attributes in Human body eventually in medicine are Gurvāḍi Guṇa that are also known as Sharīra/ 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) Sṭhīra (steadiness/ stabilise) 9) Sibula (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-Mahābhūta dominant composition in cells indicated through its physiology that specify its prevalence of Ushna, Tikshna, Ruksha, Sukshma, Laghu attributes in varied quotient. It has to determine by its role in body functions.

The above 10 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 Gurvāḍi 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 Guṇa. This subject is rarely studied to find out precise biochemical mechanism of the interrelation between food and their Guṇās (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.

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Scientific name</th>
<th>Common name</th>
<th>Snigdha/Ruksha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OryzaSativa</td>
<td>Shashtishali</td>
<td>Snigdha</td>
</tr>
<tr>
<td>2</td>
<td>OryzaSativa</td>
<td>Shashtishali (Roasted)</td>
<td>Ruksha</td>
</tr>
<tr>
<td>3</td>
<td>HordeumVulgare</td>
<td>Yava</td>
<td>Ruksha</td>
</tr>
<tr>
<td>4</td>
<td>HordeumVulgare</td>
<td>Yava (Roasted)</td>
<td>Ruksha</td>
</tr>
<tr>
<td>5</td>
<td>OryzaSativa</td>
<td>Raktashali</td>
<td>Snigdha</td>
</tr>
<tr>
<td>6</td>
<td>OryzaSativa</td>
<td>Raktashali (Roasted)</td>
<td>Ruksha</td>
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<tr>
<td>7</td>
<td>OryzaSativa</td>
<td>Basmati</td>
<td>Snigdha</td>
</tr>
<tr>
<td>8</td>
<td>OryzaSativa</td>
<td>Basmati (Roasted)</td>
<td>Ruksha</td>
</tr>
<tr>
<td>9</td>
<td>OryzaSativa</td>
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<tr>
<td>10</td>
<td>OryzaSativa</td>
<td>Kolam (Roasted)</td>
<td>Ruksha</td>
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<td>11</td>
<td>OryzaSativa</td>
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<td>Snigdha</td>
</tr>
<tr>
<td>12</td>
<td>OryzaSativa</td>
<td>Ambemohar (Roasted)</td>
<td>Ruksha</td>
</tr>
<tr>
<td>13</td>
<td>PhaseousAureus</td>
<td>Mudga</td>
<td>Ruksha</td>
</tr>
<tr>
<td>14</td>
<td>Linum Ustitatissum</td>
<td>Jawas</td>
<td>Snigdha</td>
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<td>15</td>
<td>Sesamum Indicum</td>
<td>Teela</td>
<td>Snigdha</td>
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<tr>
<td>16</td>
<td>Triticum Sativa</td>
<td>Godhum</td>
<td>Snigdha</td>
</tr>
<tr>
<td>17</td>
<td>Sorghum Vulgare</td>
<td>Jawar</td>
<td>Ruksha</td>
</tr>
</tbody>
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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 H₂O₂ 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) and correlated with Ruksha Guṇa (attribute) which is dynamic energy source although it can still undergo redox chemical reactions. Hence, these results clear indicate that 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 Ruksa and Snigdha properties of samples. Ruksa 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 Ruksa Guṇa which is dynamic energy source although it works in conjunction 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 Sāmānya- Viśeṣa, Santarpana-Aparatpama 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:


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