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IMMUNOMODULATORY INSIGHTS OF *AYURVEDA*: A CRITICAL REVIEW OF AYURVEDIC CONCEPTS AND CONTEMPORARY CORRELATIONS IN THE LIGHT OF *RASAYANA*

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ABSTRACT

Concept of human defense mechanism is long acknowledged in Ayurveda which is now understood in modern system as Immunity. The immune system protects the body like a guardian from harmful influences from the environment and is essential for survival. The immune system in a broad sense is a mechanism that allows a living organism to discriminate between "self" and "non-self'" and maintains homeostasis by eliminating damaged cells and removing pathogens from body. In Ayurveda the system that protects human body from diseases has been termed as *Vyadhikshamatva*. In Ayurvedic literature human defense mechanism also has been categorized into two functional segments, *Vyadhiutpad pratibandhakatwa* (Defense mechanism that acts against causative factors of diseases) and *Vyadhi bala virodhitwa* (Defense mechanism that prevent the progression of a disease). *Vyadhikshamatva* in Ayurveda is synonymous to *Bala*, the innate capacity for disease resistance. Based on the scope of intervention to

modulate, *Bala* has been categorized into three types, *Sahajabala* (Defensive mechanisms which are innate in nature), *Kalaja bala* (Defensive mechanisms which are modulated according to seasons or age) and Yuktrikrita bala (Defensive mechanisms which can be modulated by dietary and therapeutic intervention). *Sahaja Bala* has been introduced in Ayurveda based on the scope of modulation. Sahaja Bala are not modifiable according to Ayurveda. *Kalakrita Bala* may be considered as modulation of immune mechanism associated with age and seasons. Concept of *Yuktrikrita Bala* provides a therapeutic option to strengthen human defense mechanism. According to *Acharya Chakrapani Dutta*, *Yuktrikrita bala* may be achieved by administration of various *Rasayan yoga*. In Ayurveda, *Rasayana* drugs are considered as the natural agents, which combat age related degenerations and subsequent pathological condition. This comprehensive review article has been written to establish the concept of Immune Modulation and *Rasayana* in Ayurveda by bridging Ayurvedic Wisdom and Modern Immunology.

KEYWORDS: *Ayurveda*, Immunity, *Vyadhikshamatwa, Bala, Rasayana*.

INTRODUCTION

The term ‘immune’ has been derived from the Latin word ‘immunis’ meaning free from burden. The immune system protects the body like a guardian from harmful influences from the environment and is essential for survival. The immune system in a broad sense is a mechanism that allows a living organism to discriminate between "self" and "non-self.”.[1] It is the most complex system in human body made up of different organs, cells and proteins. Immune system is involved in

- Recognizing and neutralizing harmful substances (both self and non-self-substances)
- Maintains homeostasis by eliminating damaged cells and removing pathogens from body.

The immune system can be activated by many non-self-substances collectively known as antigens. Immune system usually does not act against body’s own component in healthy individual. If it occurs it is called an autoimmune reaction.

There are two main segments of the immune system

- Innate immune system – It is associated with nonspecific immune response [2] and traditionally, innate immunity was assumed to be rapid.
- Adaptive immune system or acquired immune system - It is associated with specific immune response and generation of immunological memories.[3]

Immune system includes both humoral immunity components and cell mediated immunity components.

- Humoral immunity – Humoral immunity is mediated by macromolecules found in extracellular fluid such as secreted antibodies, complement proteins etc.[4]
- Cell mediated immunity (CMI) – Cell-mediated immunity is mediated by phagocytes, cytotoxic T lymphocytes etc.

While the humoral response mainly protects against extracellular pathogens and toxins, CMI is responsible for detecting and destroying intracellular pathogens, e.g., cells infected with viruses or bacteria. In addition, CMI is vital for graft rejection and destruction of tumour cells and for delayed-type hypersensitivity reactions.

VYADHIKSHAMATVA OR *BALA* IN *AYURVEDA*

A unique concept of human defense mechanism has been described in *Ayurveda*. The system that protects human body from diseases has been termed as *Vyadhikshamatva*.[5] *Vyadhikshamatva* are also refers to *Bala*.[6]

According to *Acharya Chakrapani Dutta*, the defense mechanism of human body acts against diseases via two distinct pathways[7] –

1. *Vyadhi utpad pratibandhakatwa* (Removal of causative factors of diseases immediately after exposure)
2. *Vyadhi bala virodhitwa* (Defense against the progression of a disease)

A first line of defense against harmful substances is provided by *Vyadhi utpad pratibandhakatwa* in a nonspecific manner whereas *Vyadhi bala virodhitwa* acts as second line defense mechanism when *Vyadhi utpad pratibandhakatwa* fails to remove the harmful substances. *Vyadhi bala virodhitwa* are usually disease specific and prevent the progression of a disease.

SCOPE OF INTERVENTION TO MODULATE BALA

Based on the scope of intervention to modulate, *Bala* has been categorized into three types[8] -

1. *Sahaja bala* (Defensive mechanisms which are innate in nature)
2. *Kalaja bala* (Defensive mechanisms which are modulated according to seasons or age)
3. *Yuktrikrita bala* (Defensive mechanisms which can be modulated by dietary and therapeutic intervention)

Sahaja bala have been mention as an innate type of *Bala* [9] and no other way of modulation has been mentioned in context to *Sahaja bala.* The mental strength of an individual also has been considered under this.[10]

Kalaja bala refers to the alteration of *Bala* according to seasons and age of an individual.[11] The scope of therapeutic and dietary intervention to enhance *Bala* are solely found in case of *Yuktikrita Bala*.[12] According to *Acharya Chakrapani Datta*, *Rasayan* drugs may be used for this purpose.[13]

RASAYAN IN AYURVEDA

Rasayana group of drugs are one of the unique contributions of *Ayurveda*. *Rasayana* has been mention as the group of drugs that *ameliorates especially age associated degenerative changes and subsequent diseases.[14] According to Acharya Charak, Rasayana therapy has following beneficial effect [15]* –

- *Dirghamayu* (Longevity)
- *Smriti* (Improved memory)
- *Medha* (Improved cognitive function)
- *Arogya* (Non morbid state)
- *Deha-indriya Bala param* (Optimum functional status of *Deha-bala* and *Indriya- Bala*)

So, it may be considered that age associated *degenerative changes is one of the prime targets of Rasayana* therapy. An immense interest on *Rasayana* is evident in various *Ayurvedic* literatures.

DISCUSSION

Immune System *vis a vis with Vyadhikshamatva* or *Bala*

The concept of *Vyadhikshamatva* or *Bala* bears a resemblance with human immune defense mechanism. Human immune system is broadly classified into two functional segments –

- Innate immune System – Innate immunity is classically characterized by nonspecific immune response immediately after the exposure of pathogen, a protective inflammatory response is generated by innate immune system. Moreover, innate immunity plays a central role in activating the subsequent adaptive immune response.[16] The innate immune system is emerging as a critical regulator of human inflammatory disease.
- Acquired Immune System - It is associated with specific immune response and generation of immunological memories. Specific acquired immunity against pathogen may be

mediated by antibodies and/or T lymphocytes. Specific immune response mediated by antibodies may results in [17]

- Complement-dependent bacteriolysis or
- Opsonophagocytosis or
- Neutralization of viruses or toxins

T lymphocytes mediated specific immune response is associated with detecting and destroying intracellular pathogens.[18]

Immune system includes both humoral immune components and cell mediated immune components. Humoral immunity is mediated by macromolecules found in extracellular fluid such as secreted antibodies, complement proteins etc. [19] Cell-mediated immunity is mediated by phagocytes, cytotoxic T lymphocytes.

In *Ayurvedic* literature human defense mechanism also has been categorized into two functional segments

- *Vyadhi utpad pratibandhakatwa* (Defense mechanism that acts against causative factors of diseases)
- *Vyadhi bala virodhitwa* (Defense mechanism that prevents the progression of a disease)

Vyadhi bala virodhitwa may be considered as second line defense mechanism which act when *Vyadhi utpad pratibandhakatwa has* become ineffective and the course of *Vyadhi* has been activated. So, it may be inferred that the concept of *Vyadhi utpad pratibandhakatwa* represents a defense mechanism similar to innate immunity which is activated immediately after the exposure of pathogen to remove the causative factors. In other hand, the concept of *Vyadhi bala virodhitwa* indicates a defense mechanism similar to acquired immunity which is associated with specific immune response and activated to ameliorate the progression of diseases.

Concept of qualitative aspect of immune system vis a vis with *Sahaja Bala*

Concept of *Sahaja Bala* has been introduced in *Ayurveda* based on the scope of modulation. *Sahaja Bala* is not modifiable according to *Ayurveda*. Hence, it may be inferred that the concept of *Sahaja Bala* correlates with qualitative aspect of immune system. Specific action of immune components may be considered as *Sahaja Bala* such as –

- Phagocytic activity of macrophage

- Antigen dependent immune response by B-cell
- Immune pathway of complement proteins
- Immune response by cytotoxic T lymphocytes

Concept of Immunomodulation with Age and Seasons

The concept of *Kalakrita Bala* also has been introduced in *Ayurveda* based on the modulation of human defense mechanism. *Kalakrita Bala* is modulated by age and season. Hence, *Kalakrita Bala* may be considered as modulation of immune mechanism associated with age and seasons. The immune systems of very old individuals are characterized by loss of immune cells, lymphopenia and reduced diversity of variable receptor genes on B cells and T cells.[20] Seasonal changes may affect in the expression of genes which are thought to be unique to specific immune cell subpopulations.[21]

Concept of immune modulation *vis a vis with Yuktikrita Bala*

Concept of *Yuktrikrita Bala* provides a therapeutic option to strengthen human defense mechanism. According to *Acharya Chakrapani Datta*, *Yuktrikrita Bala* may be achieved by administration of various *Rasayan yoga*. Similarly, in conventional system immune modulators are designated to regulate or alter the scope, type, duration or competency of the immune response.[22] Hence the concept of *Yuktikrita Bala* bears a resemblance with immune modulation. T-helper 1 (Th1) and T-helper 2 (Th2) cells direct different immune response pathways. Th1 cells drive the cellular immunity to combat whereas Th2 cells drive the humoral immunity. Overactivation of either pattern can cause disease, and either pathway can down-regulate the other.[23] The balance between Th1 and Th2 cytokines is important for the outcome of several infectious diseases.

***Rasayana* and Immunity are Conceptually Synonymous**

Jara (Aging) is considered as a natural phenomenon. In *Ayurveda*, *Rasayana* drugs are considered as the natural agents, which combat age related degenerations subsequent pathological condition. According to the theory of oxidation-inflammation to explain the aging process, the chronic oxidative stress that appears with age affects all cells especially those of regulatory systems such as nervous, endocrine and immune system and the communication between them. Dysregulation in immune system produces low grade inflammatory state in the aging process.[24] The phenomenon where adaptive immunity declines in the process of aging, is called immunosenescence, while the phenomenon where

innate immunity is activated, coupled with the rise of proinflammation is called inflamm-aging.[25] Age-associated deterioration in the immune system, contributes to an increased susceptibility to infectious diseases, autoimmunity and cancer in the elderly.[26]

Imbalance in Th1/Th2 cytokines profile has been found to be associated with aging which are thought to play a role in immunosenescence.[27] It has been proposed that several age-related changes in immune cell functions could be good markers of health, biological age and longevity.[28] Hence, reducing the impact of age on immune system and retrieving the immune homeostasis as well as improving redox status may prevent the deleterious effects of aging.

A number of *Rasayana* drugs have been found to ameliorate oxidative stress either by raising the levels of endogenous antioxidant defenses or as an exogenous antioxidant.[29],[30],[31],[32] Various *Rasayana* drugs also have been found to exhibit immunomodulatory function and reclaim immune homeostasis. *Haritaki* which is a well-known *Rasayana* drug upregulates the activity of Th1 and reduces the production Th2 cytokine.[33]

Another *Rasayana* drug, *Satavari*, stimulated immune cell proliferation and IgG secretion in a dose dependent manner. It stimulates interleukin (IL)-12 production and inhibites production of IL-6. It also has strong modulatory effects on Th1/Th2 cytokine profile.[34]

CONCLUSION

The basic concept of innate and acquired immunity has been described in *Ayurveda* in terms of *Vyadhi bala virodhitwa* and *Vyadhi utpad pratibandhakatwa.* In *Ayurvedic* literature scope of immune modulation also has been elaborately mentioned in context to *Trividha Bala* (*Sahaja Bala*, *Kalaja Bala*, *Yuktrikrita Bala*). *Ayurveda* acknowledges *Rasayana* as a group of drugs as well as therapeutic modalities. They individually or collectively *ameliorate especially age associated degenerative changes and subsequent diseases.* A target to improving redox status and maintaining immune homeostasis may help to achieve the goals of *Rasayan* therapy. Hence, it may be inferred *Rasayana* therapy may act as an agent to reduce oxidative stress as well as retrieve immune homeostasis.

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