



A CONCEPTUAL REVIEW ON BIOMARKERS IN AYURVEDA

Tanya Chadha¹, Pranav Yadav², Pooja Rana³, Sanjay Kumar Singh⁴

¹P.G. Scholar, Department of Rog Nidan Evum Vikriti Vigyan, Rishikul Campus, UAU.

²P.G. Scholar, Department of Swasthavritta, Uttaranchal Ayurvedic College, UAU.

³P.G. Scholar, Department of Rog Nidan Evum Vikriti Vigyan, Rishikul Campus, UAU.

⁴Professor, Department of Rog Nidan Evum Vikriti Vigyan, Rishikul Campus, UAU.

Corresponding Author: tanyachadha14@gmail.com

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ABSTRACT

Biomarkers are physical properties of the human body considered and interpreted as indicators of everyday phenomena. They indicate various biological processes, pathological processes, and drug intervention responses. In *Ayurveda*, the concept of biomarkers is unexplored but can be understood from multiple perspectives. *Ayurveda* believes in a multi-dimensional approach that not only pays attention towards healing but also emphasises the healthy longevity of a person. *Dosha*, *Dhatu*, *Mala*, *Agni* and the *Srotas* patency are considered an integrated aspect of the human body in *Ayurveda*. These components play a significant role in maintaining a person's health status. Imbalance in the state of *Dosha*, *Dhatu*, *Mala*, *Agnidusti* and *Srotodusti* results in changes in the body's physiological functioning, leading to the manifestation of various diseases. These diseases must be indicated by various markers that may help in reaching a diagnosis. The present article demonstrates bodily changes created by imbalance to provide an understanding of biomarkers.

Keywords: Biomarker, *Ayurveda*

INTRODUCTION

A biomarker is a defined characteristic measured as an indicator of normal biological processes, pathogenic processes or responses to an exposure or intervention. More specifically, a biomarker is anything that can be used to indicate a particular diseased state or any other physiological state of an organism. Biomarkers have been used in clinical medicine for decades and, with advances in molecular biology, have entered a whole new era. The role of biomarkers has been exponentially increasing in guiding decisions in every phase of drug development, from drug discovery and preclinical evaluations through each phase of clinical trials and into post-marketing studies.

Biomarkers are essential to understand any disease through a broad spectrum. It is the alteration in the constituents of tissues or body fluids that reflect the severity or presence of some disease state. Anything that can be used to indicate a particular disease state can be considered a biomarker. In *Ayurveda*, *Dosha Dushyadi* components are an important aspect of maintaining a person's health status. When significant *Dosha* imbalance, *Dhatu Kshaya*, *Agnidusti*, *Mala Sanchaya*, and *Srotodusti*, occurs, it manifests *Vyadhi*. A biomarker is a parameter that can be used to measure the progression of a disease and the effects of treatment that depicts prodromal signs and clinical symptoms and is used for screening or diagnosis. Progression of disease depends upon *Samprapti* that includes *Nidana*, *Purvarupa*, *Rupa*, *Upasaya-Anupasaya*, *Samprapti*, *Upadrava*, *Sadhya-Asadhyata*, *Arishta Lakshanas*. Thus, in *Ayurveda*, all these features may be regarded as Biomarkers. Ideal biomarkers are the ones that are accurate and can be adjustable with treatment, not susceptible to being influenced by the outside environment. They are classified based on disease and are considered as predictive biomarkers, diagnostic biomarkers, and prognostic biomarkers. Various other biomarkers are mentioned, which will be discussed further.

MATERIALS AND METHODS

Classical texts and modern literature are reviewed, and understanding has been put forth in the context of biomarkers.

CLASSIFICATION OF BIOMARKERS

Biomarkers can be classified based on different criteria.

Based on their characteristics, they can be classified as

Imaging biomarkers

It is a biological feature or biomarker detectable in an image. It is a feature relevant to a patient's diagnosis, e.g., CT, PET, MRI.

Molecular biomarkers refer to non-imaging biomarkers which allow their measurements in biological samples (e.g., plasma, serum, cerebrospinal fluid, bronchoalveolar lavage, biopsy).

Biomarkers can also be classified based on their application, such as

Diagnostic biomarkers

These give intervention-independent information on identifying or aid in identifying whether the disease or a disease subcategory is present or absent. Diagnostic biomarkers define a population with a specific disease. They may be simulated with *Lakshanas* of disease, e.g., cardiac troponin for the diagnosis of myocardial infarction, *Vrishchikvansa Vedana* in *Aamvata*, and *Haridra Netra Mutra Twak* in *Kamala*.

Surrogate Biomarkers

It is intended to substitute for a clinical endpoint. It is further expected to predict clinical benefits based on involvement of bodily components. Clinical endpoints may also be taken as *Arishta Lakshanas* as they predict the health status like *Indriya Gamiya Arishta*, *Purvarupeya Arishta*, *Lakshana Arishta*. E.g. *Dhatukshaya* in *Rajyakshama*, *Ojo visramsas* in *Prameha*, *Rakta Kshaya* in *Pandu*.

Prognostic biomarkers

It gives information on disease status by measuring the internal precursors that increase or decrease the likelihood of attaining a disease. Prognostic markers form the basis for establishing the prognosis. It may be related to *Sadhya Asadhyata* of any *Vyadhi*. *Taila*

Bindu Pareeksha also helps establish a prognosis. e.g. *Maha hikka* is *Asadhya*, *Tamaka shwasa* is *Yapya*.

Predictive biomarkers

It measures the effect of a drug and tells if the drug is having its expected activity. e.g. when an individual is exposed to a drug or toxin, the concentration of that drug or toxin within the body provides a more accurate prediction for the effect of the drug or toxin compared

Pharmacodynamic biomarkers can measure the direct interaction between a drug and its receptor, which is particularly relevant to drug mechanisms.

Biomarkers of immunotoxicity

The interaction between diet and host factors regulates *Agni*. Food digestion depends on *Prakriti*, the status of *Doshas*, *Agni*, and digestive factors. *Virudha Ahara Sevana* increases susceptibility to various metabolic diseases. This affects the person's *Ojas* and *Vyadhikshamatva* and may affect the immune system. Elevated levels of antibodies indicate sensitisation in conditions like *Tamaka Swasa*, *Sheetapitta*, *Udarda*, and *Pratishyaya*.

Inflammatory biomarkers

Ama interacts with *Dusta Dosh* and *Dhatu*, causing *Srotorodha* and responsible for inflammation and tissue damage due to a change in their biophysical properties. *Ama* circulates and interacts with excretory products, gets localised in the micro-channels of the body, becomes toxic, and forms pro-inflammatory waste products that trigger pathogenesis and hamper various physiological functions. *Ama* can be found on the tongue and in urine, thus considered a reliable biomarker that links abnormal digestive status with the onset of inflammation.

Biomarkers for Susceptibility

There are innumerable factors responsible for a person's health status that influence the susceptibility of exposed individuals. *Sroto vaigunyata* reflects the area of susceptibility through acquired factors or genetic predisposition that influences the response to exposure, which is different in different individuals and triggers *Vyadhi Utpatti*.

Physiological biomarkers

Jara, or old age, has been considered a natural phenomenon associated with a significant imbalance in *Doshas* and *Dhatu Kshaya* due to increased catabolic activities. As mentioned by *Acharya Sarangdhar*, a faculty gradually declines in each decade of life. *Dhatu Kshaya*, along with alteration in normal functions of *Doshas*, is gradually evident in the ageing process. These may be used as *Ayurvedic* biomarkers of *Jara*.

Importance of Biomarkers

Biomarkers are significant to medicine in general. They are integral to drug development; they're really critical because we need to measure the effects of investigational drugs on people during the clinical trial. So, it's really important that we have a wide range of biomarkers that can measure everything we want to know about the effect of the investigational drug on people.

DISCUSSION

Everyday interactions between *Doshas* and *Dhatu*s are essential for maintaining good health. Accordingly, individuals with abnormal *Doshas* and *Dhatu*s are more vulnerable to pathognomic conditions. It also weakens the *Agni*, which decreases immune surveillance. Alteration in these bodily components results in disease manifestation, and biomarkers can indicate these conditions well. Understanding various biomarkers is thus essential for understanding disease states and changes in physiological components.

CONCLUSION

Biomarkers are alterations in the constituents of tissues or body fluids associated with the derangement in *Doshas* and *Dushyas*, along with some subjective parameters that could be used as *Ayurvedic* biomarkers in various aspects. The principles of traditional systems of medicine could be developed into hypotheses, and concepts should be validated in light of modern scientific methods that may lead to the development of various unexplored concepts like biomarkers in *Ayurveda*.

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