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Review Article

PHARMACOLOGICAL RESEARCH IN AYURVEDA

Apte Manik M^{1*}, Sharma Govinda K², Kishore Seetarama D¹

¹PG Scholar, Department of Rasashastra and Bhaishajyakalpana SDMCA Hassan, Karnataka, India

²Associate Professor, Department of Rasashastra and Bhaishajyakalpana SDMCA Hassan, Karnataka, India

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*Corresponding Author: **Apte Manik M**

PG Scholar, Department of Rasashastra and Bhaishajyakalpana SDMCA Hassan, Karnataka, India

ABSTRACT

Ayurveda explains two types of therapy mainly, use of drugs and the other one which concentrates at use of drugless therapy for curing the diseases of suffering. The former type of therapy demands the vast and updated knowledge of herbs and minerals. The knowledge of drugs and their action in the living system is being termed as pharmacology.

The concept of pharmacology in Ayurveda developed recently, is gaining popularity and curiosity among the research scholar and practitioners with respect to action of drugs and compound formulations on the bodily tissues.

The research conducted in this field these days, as a part of drug research has helped understand action of drugs based on their constituents like alkaloids, terpenoids, glycoside tannins and flavonoids. The action of constituents is explained as per contemporary sciences like antibacterial, antifungal, anti-inflammatory, analgesic and anti-cancerous. The various pharmaceutical technologies developed concentrate on extraction of a particular constituent which is further remodeled to get a new molecule derived from an original constituent.

Ayurveda is a holistic science and it considers the herb as a whole. The various constituents of the herb can be assisting, resisting, buffering, modifying, and reducing the side effects, synergistic in action in relation to one other. Though a number of pharmacological protocols are in use for investigation of constituents of single and compound drugs, the knowledge of the pharmacodynamics of these drugs could not be understood. Recent researches show the presence of taste receptors in human body apart from the tongue. Hence there is a need for research of drug action based on its taste, potency and final stage of digestion.

Application of pharmacology in Ayurvedic research has given many gains despite the limitations. The advantages and limitations of pharmacological investigations in Ayurveda drug research is detailed in this paper.

Keywords: Pharmacology, Drug, Constituents, Research, Pharmacodynamics.

INTRODUCTION

Ayurveda is a science of life and it has got two main aims mainly maintaining the health of an individual and curing the diseases of the suffering individual¹. The fulfillment of the first aim is based on following of the various procedures which are part of daily regimen and seasonal regimen. It also explains following the code of conduct in various aspects of life. The next aim of Ayurveda explains the use of two types of therapies mainly use of medicine, and treatment of diseases without the use of drug. The former kind of treatment procedure demands the updated knowledge of herbs and minerals which form an integral part of the Ayurvedic drug. This vast knowledge of drug and its action is termed as pharmacology.

Pharmacology developed in Ayurveda recently is gaining popularity among the research scholars. The concept of

pharmacology has got two aspects pharmacodynamics and pharmacokinetics. Pharmacodynamics is the quantitative study of the biological and therapeutic effects of drugs². Generally it is explained as what drug does to the body. Pharmacokinetics is study of the absorption, distribution, metabolism and excretion of drugs and their relation to pharmacologic response². In common language pharmacokinetics is what body does to the drug.

The pharmacological research in Ayurveda has been developed as a part of drug research. Drug research with respect to herbal medicine is a collective term comprising the GACP (good agricultural and cultivation practices) pharmacognostical research, pharmacological research, development of new molecule of drug from the isolated constituents of herbs and their actions. GACP explains application of innovative practices and methods in cultivation of medicinal plants increasing their yield and maintaining the

quality of the crude drug. Pharmacognostical research deals with the identification of plants based on their morphology and microscopic appearance of the crude drug and identification of the drug based on the markers present in the drug.

Pharmacological research has advanced in the last decade and many researchers have been conducted. It will not be wrong to state that comparatively less research have been conducted in field of Ayurveda compared to other fields like Botany, Biotechnology Microbiology Pathology and other contemporary medical sciences in relation to herbs and their constituents. And it is with these combined efforts that many research protocols have been developed to estimate the constituents of the drug and their action on various tissues in diseased condition. The advancement of the pharmaceutical technologies simultaneously has also helped to extract and isolate a particular constituent of a herb having potent action against some disease conditions and some microorganisms. The Phytoconstituents can be classified as:

1. Alkaloids
2. Glycosides
3. Flavanoids
4. Phenolics
5. Saponins
6. Terpenoids
7. Tannins
8. Anthraquinone
9. Essential oils and
10. Steroids³.

Alkaloids

Alkaloids are class of largest chemical constituents which are bitter in nature and are derived from amino acids with one or more nitrogen atom in the chain which make it more alkaline and attached to the radicals is oxygen atom which replaces the hydrogen atom in the peptide ring⁴. Some of the alkaloids are morphine, codeine, vinblastine, scopolamine, ajmaline and berberine. These alkaloids have various actions like analgesic, anticancer, antibiotic, antiarrhythmic, and antihypertensive etc⁴.

Glycoside

Glycosides are substances which are derived from sugars and are made up of carbon hydrogen and oxygen as basic entities. They are neutral in nature and are water soluble. They can have various pharmacological actions like digitoxin has cardiac inhibiting property; salicin has anti-inflammatory and antipyretic properties.

Flavanoids

Flavanoids are organic compounds that contain benzene ring structurally. The common class of flavonoids is isoflavones, flavanols, proanthocyanidines etc. They are the color pigments present in petals of flowers which facilitate pollination. They have multiple activities when studied in vitro like anti inflammatory, antioxidant, antimicrobial, antiallergic etc for which Luteolin, Apigenin, Tangeritin, Galangin, Myricetin, Quercetin are good examples⁵.

Phenolics

Phenolics are class of compounds which are derived from phenylalanine by the action of phenylalanine ammonia lyase. (PAL) They are used by the plants for their defense against

animals. They can be classified as phenolic acids, flavanoidal phenolics and non flavanoidal phenolics⁴. Rutin and hesperidine are good examples with antibacterial and antioxidant properties⁵.

Saponins

Saponins are those constituents which cause saponification when mixed with water. That is they produce foam. Structurally they are said to be made of sugar molecule combined with terpenoidal or steroidal aglycone part. Diosgenin and Hecogenin are examples. These have hormone like effects or act as their precursors while some have actions similar to cortisone and hydrocortisone. Some of them have exhibited hypolipidemic and anti cancer properties also.

Terpenoids

Terpenoids are a class of constituents which are made of 5 carbon atom basic structure isoprene. They can be aromatic in nature and are classified as monoterpene, sesquiterpene, diterpene, triterpene, tetraterpene depending on the number of carbon atoms in it. Taxol, gargarofuran, palasonin are commonest examples exhibiting antihelminthic, and anticancer properties⁵.

Tannin

Tannins are phenolic compounds which are very much of use in Ayurveda. They can be hydrolysable and condensed in structure and are named based on this property. They are used in Ayurveda for leucorrhoea, diarrhea and rhinorrhoea⁵.

Anthraquinone

Anthraquinone are phenolics and glycosidic in origin. They are derived from anthracene. Aloin has exhibited purgative, cholagogue and laxative actions. Alizarin is used as a natural red dye⁵.

Essential oils

Essential oils are aromatic class of compounds which are volatile in nature. They are present as aroma giving compounds in many of the spices. In fact these oils are a combination of many compounds itself like various alkaloids acids alcohols etc. Garlic oil has antibacterial properties⁵.

Steroids

Steroids are organic compounds with the four rings of cycloalkanes attached to each other. The phytosterols can be classified as sterols and stanols. Based on the attachment of cholesterol or hormone like compounds found in plants they can exist as glycoside or saponins also.

Many of the compounds present in the plants have been isolated for their study in living systems. This has been possible with the novel extractive procedures adopted in the pharmaceuticals. These compounds are then studied for their pharmacological action and toxicological actions in animals and humans. Some of the compounds which are found to be having profound useful actions therapeutically are developed as a drug and then this drug undergoes various stages of pre clinical and clinical research for quantification of the data. Arteether used as antimalarial is extracted from *Artemisia annua*⁶. Similarly the drug memory sure is developed from *Bacopa monnerie*. Hypolipidemic properties of *Commiphora mukul* have been exploited by the use of guggulipid⁶.

Limitations of the pharmacological research in Ayurveda

The knowledge of the herbs has reached the basic level with respect to their constituents, yet Ayurveda explains the use of the herb as a whole and not as isolated constituents. The

isolation of the constituents will hinder the action of the constituents and leads to the adverse effects of the drug which are not seen when the whole drug is given. For instance, *Rauwolfia serpentina* a well known herb useful against insomnia and hypertension has shown side effects like depression when given in isolated form as reserpine⁷. This phenomena can be explained on the basis of action of herb as a whole and not as its isolated constituents. The various constituents of any herb may be assisting to each other, or buffering, or synergistic in action or may be resisting, or also may be reducing the side effects of the other constituents. It indicates that the herb should be used as a whole in the biological systems to get the appropriate therapeutic effect and dispelling any side effects.

The action of the drug has been explained in ayurveda based on the taste, potency, qualities, and the taste of the drug at the end of the digestion. Barely any researches have been done with regards to the taste of the drug, or quality of the drug, or taste at the end of the digestion and its action on the biological systems. The drug research in the coming future should be directed based on the Ayurvedic principles of the rasa(taste), guna(quality), veerya(potency), vipaka(taste at the end of the digestion), and their relation with the Doshas(three entities-vaata, pitta, kapha) and the changes in the biological systems or organs observed after administration of the drug.

DISCUSSION

The ongoing pharmacological research on the active constituents of the herbs is steeply developing and many researches are being conducted on the identification and naming of the constituents of herbs which are commonly and more frequently used. Such herbs are used for study which has multiple effects and multiple parts are used to treat different ailments. For instance *Aerva lanata* which is traditional medicine is useful in many diseases. A leaf-decoction is prepared as a gargle for treating sore-throat and used in various complex treatments against guinea-worm. To wash Babies that have become unconscious during an attack of malaria or of some other disease are washed with a leaf decoction at the same time smoke from the burning plant is inhaled. The leaf-sap is also used for eye-complaints. An infusion is given to cure diarrhoea and in an unspecified manner at childbirth, and on sores. The root is used in snake-bite treatment. For pains in the lower part of the back leaves and flowers are reduced to ash which is rubbed into cuts on the back. It gives protection against evil spirits, is a good-luck object for hunters, and safeguards the well-being of widows⁸. Similarly *Tribulus terrestris*, *Glycyrrhiza glabra*, *Withania somnifera*, *Asparagus racemosus*, *Embllica officinalis*, and many more which are in use since ages without any untoward effects in Ayurveda. The development of technology has aided use of isolated compounds present in these herbs and their development as a drug molecule. The isolated compounds have some unwanted adverse effects also. Ayurveda being holistic science considers herb as a whole and not as its divided constituents. Some of the recent researches have shown that the different constituent of the herb can have various actions like they can be assisting, resisting,

synergistic, counteracting and reducing side effects of one another⁹. This shows that the various types of dosage forms explained in Ayurveda aim at extraction of specific principles which have got combined action which is not fulfilled by the isolated compounds.

The medicines used in treatment of diseases are usually polyherbal in nature and sometimes they are herbomineral in origin also¹⁰. This combination has got many ingredients and each herb has many constituents in it. Moreover there are biological variations in the constituents of same herb in different seasons and habitat. Thus the compound is a mass mixture of huge amount of constituents. Some of the constituents may be in large quantities and some in minute quantities. In such circumstances the action of the compound cannot be understood. In case of herbomineral formulations the complexes formed from the combination of herbal constituents and the mineral drug are practically difficult for imagination and assessment. And when these combinations are used in biological systems it becomes obscure to judge their mode of action.

Ayurveda also explains the variations in dosha, dushya, bala, kala, anala, prakriti, vaya, satwa, satmya, ahara, which makes it more intricate to assess each and every factor in patient¹¹. Depending on the variation in each factor the selection of the drug used also varies. This makes it a difficult task to understand the action of the herb or polyherbal formulation in person to person with such vast amount of variations.

Ayurveda also explains the action of the drug on the basis of taste, potency and taste at the end of digestion. Even though the research work has reached the pedestal level of the drug with respect to constituents, very few works have been done aiming at standardization of the taste and their relation in alleviation of doshas and formation of dhatus, potency of the drug and its taste at the end of digestion which form the basis of action in Ayurveda. This has motivated the scholars and now there are researches going on for the presence of taste receptors apart from tongue in the body. It has been found that umami taste receptors are found in sperm which are believed to help control release of the DNA. The bitter taste receptors called as solitary chemoreceptor cells (SCC's) are also found in nasal pathway which is believed to sense the toxins present in the airway and trigger trigeminal nerve to stop inhalation and induce sneezing. Similarly bitter taste receptors are also found in human testes whose function is believed to cause death of cells and thus reducing the mature sperm count¹². All these facts which are on the verge of ascertainment lead a ray of hope to understand the action of the herb as per Ayurvedic principles.

The variations in single & compound formulations in respect to their pharmacological attributes like rasa guna veerya vipaka prabhava could not be understood well till date through the existing devices or scientific validating technologies. The varying factors in therapeutic applications have made it more complicated.

CONCLUSION

It has been seen that herbal drugs act based on their chemical constituents like alkaloids, Glycoside, Tannins, Anthraquinone,

Terpenes, Phenolics, essential oils, Steroids, Saponins and flavanoids. Also it has been found that isolation of active constituents by use of advanced technology has led to some untoward effects when used therapeutically. Also Ayurveda explains variations in multiple factors from person to person. The medicines that are used for treating diseases are a polyherbal or herbomineral in origin. Besides Ayurvedic principles also explain the action of the drug based on taste and potency of the drug and its taste at the end of digestion. But very less research has been conducted to prove this. However the recent astounding findings like presence of taste receptors in the sperm and nasal pathway of humans whose exact functions are yet to be revealed have raised the expectations of research faculty. Thus it shows that herbal drugs act at multiple levels by virtue of their multiple constituents. And the action of drug by virtue of its taste and other factors also cannot be completely denied. Thus it can be said that there is a long way to go in pharmacological research to prove the age old principles of Ayurveda.

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