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In-silico studies in herbal drugs: A review

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ABSTRACT

Bioinformatics is the latest technology in the research field. In-silico studies are done to identify the exact target of the drug. Which finds a drug for the particular binding site and final stage animal testing can be done for obtaining a conform result. Reviews of in-silico studies in herbal drugs were retrieved through the use of PubMed. Specific software on a computer allows researchers to analyse enormous data without actually conducting a large number of experiments. It helps to give the existing information to model disease pathway and identifies precise targets of the selected drugs. Modern instrumental techniques like XRD, XRF, ICP-MS etc. help in quantitative and qualitative estimation of metals and minerals and structural analysis of compound drugs. A later stage in vivo and in vitro studies can be done for obtaining the confirmatory result.

Keywords: *In-silico*, Herbal drugs, Bioinformatics.

INTRODUCTION

Using a set of complex pharmaceutical combinations in treatment is one of the most important aspects of therapeutics. So, to evaluate the proper therapeutic value or the clinical efficacy of the multicomponent/polyherbal formulations needs modern technology.   Bioinformatics plays an important role in medical science by identifying the exact cell, genes, proteins being affected and to screen the active protein among them. Biology has been transformed into an information science where molecular processes can be addressed computationally. In the research field, *in-vivo* and *in-vitro* studies have an important role before the clinical trials of a new medicine. So, to confirm the target cell of the particular medicine the bioinformatics plays a vital role before going to *in-vivo* studies.

Methodology through Bioinformatics

1. The test sample is prepared according to the reference
2. The test sample was analysed for structural changes and ionic forms using analytical techniques like XRD, XRF, NMR, IR at a recognized laboratory.
3. The analysed data was used for the bioinformatics software e.g. Linux for the analysis.
4. Based on the structures identified by the above analytical techniques, the computer program generates a structural formula and utilize this structure to assess the protein linkage of the molecule to various proteins in the DNA of human body with various permutations and combinations.
5. The frequency of adhesion of each of the protein linkages is calculated-lesser the frequency faster will be the effect; higher frequency effect was slower of the drug.
6. Like this, we can consider the protein targeted cell.

***In-silico* Studies in herbal drugs**

Post-traumatic stress

An herbal formulation *Free and Easy Wanderer* used as antioxidation therapy in post-traumatic stress

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disorder. Ten compounds selected from the extract counteracted H$_2$O$_2$-induced oxidative stress [1].

Liver disorder

The study of Drug *Radix salviae miltiorrhizae* (Danshen) in liver diseases shows Danshensu exhibits the largest number of hepatoprotective target connections among the six active compounds [2].

Cardiovascular diseases

[3] A study on Cardiovascular diseases including thrombosis, which is induced by platelet aggregation. By the usage of 38 compounds have significant potential for development of anti-thrombosis drugs ranked with a DockScore above 70.

[4] One more study shows a positive result of the Danshen drug in cardiovascular and cerebrovascular disease.

[5] Another study on ischemic heart disease treated by Chinese herbal formula *Huo Luo Xiao Ling Dan* .This predict the molecular interactions between the major active components of apoptosis. [6] Salvianolic acid B from Salviae mitiorrhizae, in the treatment of cardiovascular diseases in China.

Hypertension

[7] A study done for reducing hypertension by CYP11B2 inhibitor provided a new approach to discover novel CYP11B2 inhibitors from Traditional Chinese Medicine.

[8] In this study Theobroma cacao bean alcoholic extract improves cell viability and reduce IL-6 and sVCAM-1 in endothelial cells induced by plasma (pre-eclamptic patients).

Infection & inflammation

[9] Commonly used in anti-infection treatments in Chinese medicine includes the synergistic effects combination of drugs with oxacillin or gentamicin. [10] One more study on Traditional Chinese herbs have a considerable number of drug-like natural products and predicted activities to the targets of approved drugs and usage of these herbs as a chemical resource library for discovery of anti-infective and anti-inflammatory drugs. [11] Another study on extracts from Ziziphus spina-christi for their anti-inflammatory effects.

Malaria

[12] Artemisinin is a promising new antimalarial agent.

[13] Chikungunya

This study focused on the draggability Nilavembu Kudineer and Swasthya Raksha Amruta Peya to heal virus infection of chikungunya.

Tetanus

[14] Phytoligands selected based on literature and pharmacophoric studies. These leads can be used as potential inhibitors against tetanolysin.

Myasthenia gravis

[15] Myasthenia gravis treated with Buzhongyiqi decoction shows key active components decoction used to discovered five new AChE inhibitors.

Cholesterol

[16] Acyl- coenzyme and Ten compounds finally obtained with predicted inhibitory activities toward ACAT-2.

Alopecia.

[17] This present study was aimed to identify prostaglandin D2 synthase inhibitors which is discovered as for treatment of androgenic alopecia.

Insomnia

[18] Kadsura longipedunculata used for the treatment of insomnia because of its sedative and hypnotic effects.

Hemiplegia

[19] Huatuo reconstruction pill treats for hemiplegia and post-operation of brain stroke. [20] This study Identified Amygdalin and paeoniflorin as key active constituents of Buchang Naoxintong in cerebral ischemia..

Diabetics mellitus

[21] In the *In -silico* analysis 20 enriched targets predicted for the constituents of Cassia auricuata involved in insulin signaling pathways. Cassia auriculata enhances uptake of glucose and expression of glucose transporters. [22] Again a study on Plant Grewia hirsuta for diabetes. [23] A study to discover novel anti-diabetic drugs. [24] Anti-diabetic drugs have iridoid and secoiridoid glycosides as active chemical components, study shows the inhibition of glycogen phosphorylase-a activity is a common target for iridoids and secoiridoids to elicit anti-diabetic effects. [25] Another study deals with isolated compounds of herb *Pueraria lobata* in type II diabetes mellitus. Compound lobatflavate and 3*S*,4*R*-tuberosin shows remarkable α-glucosidase inhibitory activity.

[26] This study in compounds from Stephania Hernandifolia have been confirmed plants against TB and cancer, diabetics.

Iron deficiency

[27] A study of piperine in iron deficiency suggests that conjugating piperine with iron slow down the metabolism of iron, thereby piperine probably enhances the bioavailability of iron.

Asthma

[28] A study on piperine and its derivatives to detect Lipoxygenase inhibitory activity shows higher significance for medicinal applications.

[29] Another study shows molecular simulation indicates that the MOL376 incough and Asthma.

Alzheimer's disease

[30] This study assessed inhibitory action against AChE and BChE and metal-chelating capacity of *Perovskia atriplicifolia* and *Salvia glutinosa*. [31] A study on Anti-Alzheimer's Disease Mechanisms of Icariin. [32] One more study to analyze Anticholinesterase and antioxidant activities of Terminalia chebula fruit.

Cancer

[33] Scopoletin is constituent in *Artemisia annua* L. Scopoletin might serve as the lead compound for drug development. [34] A study on herbal lead compounds in Prostate Cancer. [35] Another study on Danshen for its anti-cancer effects. [36] Roots of Rheum undulatum has having components that are anthraquinone and stilbene derivatives, such as emodin, aloe-emodin, resveratrol, rhaponticin, and isorhapontin and demonstrate sEH inhibitory, antibacterial, antioxidant, anticancer, and anti-inflammatory activity. [37]*Psoraleacorylifolia* plant is used for its anti-tumor effects. Major

components in seed is psoralidin. [38] This study Discover novel lead for non-small cell lung cancer. This study suggests the triptolide in Cancer treatment. [39] Another study on liver tumor treated by Fuzheng Yiliu decoction. 11 constituents, showed better anticancer activity towards the cell of HepG2 cancer. [40] The X-linked inhibitor of apoptosis as a new molecular target for anticancer drugs used to resist the cancer cells to chemo and radiation therapy. [41] Phytochemical studies on active anti-colorectal cancer compounds Alkanna tinctoria and isolated eight quinone compounds. Among that alkannin, angelylalkannin, 5-methoxyangenylalkannin compounds show strong antiproliferative effects.

HIV

[42] This study shows enhance therapeutic options against AIDS by examining compounds of 4-thiazolidinone and its derivatives because of its antiviral action. [43] Another study, used to find lead molecules from the library as HIV-1 reverse transcriptase inhibitor.

Epilepsy

[44] This study deals with derived compounds of some herbal drugs and its quantitative structure-activity relationships done to found the inhibitory activity in epilepsy.

In skin

[45] This study found penetration activity of menthol which was found increase in temperature and concentration with a range between 1–20% increases menthols penetration increasing capacity.

[46] A study on on ginger and its 12 main components and human cytochrome P450.

[47] Use of medical herbs and its pharmacokinetic and dynamic effects against cytochrome P450.

[48] Interaction of Fangjifuling decoction, with CYP2D6 by virtual screening.

Contraceptive

[49] Piperine as a contraceptive in males.

DISCUSSION

Bioinformatics is a research methodology in which using standard analytical techniques to find out action of complex mixture. Applying this, it is possible to decode the complex Ayurvedic formulations by using analytical tools like XRD, XRF, ICP-MS and the data from these can be processed to identify the structural formula. This structural formula can be used to assess the binding of the molecule to various proteins/receptors using standard database/software. From this review, we can identify that In-silico studies were more used in Chinese medicine. This study helps to identify the exact target site and all the above studies undergone the in-vitro, in-vivo studies later. Many studies are found in Traditional Chinese medicine to propagate the herbal medicine in china. [50] A Study found to understand the molecular mechanisms of TCM. [51] Another study reveals that usage of Traditional Chinese Medicine instead of conventional medicine. To study and explore TCM Quantitative information is important. TCM-ID gives information about number of prescription as 1588, herbs- 1313 herbal ingredients-5669, and 3725 herbal ingredients by its 3D structure. [52] Herb-drug interaction happened by enzymatic induction and inhibition. This interaction can be affect the circulation of drug and changes the clinical result.

CONCLUSION

Bioinformatics is an approach which can be used to design novel combinations by first validating the concept on a computer and validating scenario. It solves many problems related to drug standardization, safety, and efficacy of the medicines. The latest technology which helps to reduce the time and resources required for an in- depth research in herbal formulations and Rasaushadhis. It is possible to assess particular drug with specific disease cell without any clinical trial. Bioinformatics-as a methodology in preclinical analysis of Rasausadhi helps to perform the in-vivo studies in future studies.

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