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COMPUTATION AND COMPARISON OF THE DRUG EFFICACY INDICES [$Q_{(VPK)}$] OF CERTAIN *AYURVEDIC* MODERN MEDICAMENTS

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ABSTRACT

The modern scientists had developed many computational methodologies to predict the efficacy of various modern medicines including vaccines. The oriental systems like Ayurveda and Siddha use many medicaments for curing various ailments. Unfortunately, there are not much research works done to develop a suitable computational method for computing the efficacies of those medicines numerically and the available literatures blindly adopted the modern methodologies avoiding the rich philosophical bases of Ayurveda. In this research work the suitably developed computational methodology based on the concepts of Ayurveda was used to compute the Drug Efficacy Indices of certain Ayurvedic modern medicaments of AVS-Kottakkal and compared with their classical equivalents.

Keywords – Classical Medicines, Ayurveda, Modern Medicaments, Drug Efficacy Indices [$Q_{(VPK)}$]

1. INTRODUCTION

The system of alternative medicines like *Ayurveda* is practicing in India since prehistoric period with proven clinical results beyond any doubts. Recently the researchers are found concentrating more on the clinical trials of the traditional medicines and formulations blindly adopting the modern methodologies on various animal models as evident from the scientific literature forgetting these facts and the cautions of many *Rishis* regarding the traditional formulations. The emerging field of modern researches particularly the research field of medicines recently began to start using many new computational techniques and statistical methods to predict the efficacies of various drugs by minimizing the animal and human trials. The predicted efficacies of modern medicines also found in accordance with the observed efficacies many times. It is also worthwhile to understand that modern scientists even developed many successful methods to minimize the animal trials considerably with accurate results. The field of modern scientific researches became more and more interdisciplinary and they use not only the knowledge of a particular branch of science but also incorporated knowledge from many other branches of sciences to achieve their research goals. They use the knowledge content successfully from mathematics, statistics, physics etc. to solve the problems of entirely different research fields of biological sciences. The field of research of physics started incorporating the biological knowledge content along with many philosophical concepts as bases to explain their findings successfully. The artificial intelligence one of the main concepts of theoretical computer science took many practical embodiments to quench the thirst of researchers irrespective of the field of research. The modern medicinal researches develop many methods to

predict the efficacies of the drugs or chemicals under study based on the developments happened in the field of artificial intelligence. Many of the *Ayurvedic* researches blindly imitate those methodologies by incorporating them as such without any suitable alterations to the field of *Ayurvedic* drug research for simply getting modern outlook and academic superiority. Many times, these modern methodologies gave wonderful research findings that were totally against our traditional knowledge and the researchers become buffoons in front of the modern world. The prime reason of these failures is that those methodologies were developed based only on the technological bases of modern medical knowledge considering their drugs as merely simple chemical entities with almost well studied structures and possible revealed sites of actions. The *Ayurvedic* medicines except certain metal *Bahamas* are a combination of many chemicals with complicated structures that are even yet to be identified and studied scientifically. The recent scientific concept of active ingredients alone cannot successfully explain the pharmacological activities of many traditional medicines and formulations as evident from the research studies using those synthesized chemicals (active ingredients) alone as the alternatives of the traditional formulations cannot successfully produce the claimed therapeutic effects. Even the minute alterations of those traditional manufacturing processes and procedures for the modernization and commercialization also lead to the loss of desired or traditionally claimed therapeutic activities as evident from many clinical failures. We have to bow in front of the intelligent observations of the great *Rishis* who carefully designed those methodologies to prepare such formulations with great care. This supports that the trend to modernize these manufacturing methodologies also should be carefully done. The modern scientists use many successful computational methods to predict the efficacies of the modern medicines theoretically with acceptable variations and unfortunately none of those methods are advisable for the *Ayurvedic* researches due to many reasons. The traditional formulations are not simply chemicals and they are the part of *pancikrutapanca mahabhutas* and are formulated based on the *tridosha* concepts¹. Hence a computational method based on the *Ayurvedic* fundamentals alone can solve this problem of efficacy predictions successfully. In this paper the Drug Efficacy Indices of certain modern medicaments from the house of authentic *Ayurveda* the *Arya Vaidya Sala*, Kottakkal were computed and compared with the traditional formulations mentioned.

2. MATERIALS AND METHODS

The suitable incorporation of the recent developments of modern technology to the field of *Ayurveda* gave birth to various modified forms of many classical *Ayurvedic* formulations to modern medicaments like capsules/ tablets and ointments/ gels. The drug efficacy indices of certain such new generation proprietary medicines like Rhukot Tablet, Rhukot Gel, Psorakot Tablet, Psorakot Gel, Acidact Tablets, Pilocid Tablet, Pilocid Gel, Livokot Tablet, Migrakot Tablet, Migrakot Oil, Ostikot Tablet and Respihot Tablet of AVS-Kottakkal were computed using the earlier reported efficacy equation (Figure 1)². The computed $Q_{(VPK)}$ values were compared with the computed $Q_{(VPK)}$ values of their classical said equivalents or bases mentioned in the therapeutic index³.

Figure 1: Equation for computing Drug Efficacy Index $Q_{(VPK)}$

$$Q_{(VPK)} = \frac{\left| \sum_{(V,P,K)} q_{(i)} \right|}{100} + \Pi \leq 1$$

Where $Q_{(VPK)}$ is the Drug Efficacy Index, VPK represents *Vata*, *Pitta* and *Kapha* respectively and $q_{(i)}$ is the individual components for the *Vata*, *Pitta* and *Kapha* respectively. The Π represents the *Prabhava* the corrective entity that can effectively affect the therapeutic value

of the formulation that observed in the real practical world. The drugs understudies were also classified according to their respective classes based on the computed efficacies and were compared scientifically.

3. RESULTS AND DISCUSSION

The values of Drug Efficacy Indices $Q_{(VPK)}$ of modern proprietary medicines were computed using the efficacy equation and tabulated (Table 1).

Table 1: The computed Drug Efficacy Indices $Q_{(VPK)}$ and Classes of various New Generation Medicaments

Medicament	$q(V)$	$q(P)$	$q(K)$	$Q_{(VPK)}$	Pharmacological Category/ Class
Rhukot Tablet	0.00	-65.50	-34.50	1.00	<i>Kapha-Pittaghni</i>
Rhukot Gel	39.22	-21.57	-39.22	0.22	<i>Pitta-Kaphaghni</i>
Psorakot Tablet	19.87	-31.69	-48.44	0.60	<i>Pitta-Kaphaghni</i>
Psorakot Gel	40.87	-54.78	-4.35	0.18	<i>Kapha-Pittaghni</i>
Acidact Tablet	30.05	-39.90	-30.05	0.40	<i>Kapha-Pittaghni</i>
Pilocid Tablet	15.49	-15.93	-68.58	0.69	<i>Pitta-Kaphaghni</i>
Pilocid Gel	18.42	-58.26	-23.32	0.63	<i>Kapha-Pittaghni</i>
Livokot Tablet	37.31	-59.49	-3.20	0.25	<i>Kapha-Pittaghni</i>
Migrakot Tablet	33.13	-39.82	-27.05	0.34	<i>Kapha-Pittaghni</i>
Migrakot Oil	-29.60	-48.66	21.73	0.57	<i>Vata-Pittaghni</i>
Ostikot Tablet	11.98	-29.95	-58.06	0.76	<i>Pitta-Kaphaghni</i>
Respikot Tablet	27.58	-33.42	-39.00	0.45	<i>Pitta-Kaphaghni</i>

Similarly, the computed Drug Efficacy Indices of classical formulations that were mentioned as the bases of these new generation medicaments were tabulated (Table 2).

Table 2: The computed Drug Efficacy Indices $Q_{(VPK)}$ and Classes of mentioned classical formulations

Classical Formulation	$q(V)$	$q(P)$	$q(K)$	$Q_{(VPK)}$	Pharmacological Category/ Class
Balaguduchyadi Kwatha	14.29	-42.86	-42.86	0.71	<i>Pitta-Kaphaghni</i>
Balaguduchyadi Kwatha (AVS-Kottakkal Make)	0.00	-100.00	0.00	1.00	<i>Pittaghni</i>
Patolakaturohinyadi Kwatha (AVS-Kottakkal Make)	20.48	-42.97	-36.55	0.59	<i>Pitta-Kaphaghni</i>
Ayyappalakera Tailam	40.74	-55.56	-3.70	0.19	<i>Kapha-Pittaghni</i>
Ayyappalakera Tailam (AVS-Kottakkal Make)	40.81	-55.16	-4.04	0.18	<i>Kapha-Pittaghni</i>
Chiruvilwadi Kwatha (AVS-Kottakkal Make)	-1.16	2.44	-95.93	0.95	<i>Vata-Kaphaghni</i>
Dusparshakadi Kwatha (AVS-Kottakkal Make)	22.67	-17.39	-59.94	0.55	<i>Pitta-Kaphaghni</i>
Rasnasaptakam Kwatha (AVS-Kottakkal Make)	15.02	-22.53	-62.45	0.70	<i>Pitta-Kaphaghni</i>
Dasamulakatutrayadi Kwatha	27.58	-33.42	-39.00	0.45	<i>Pitta-Kaphaghni</i>
Pathyakshadhatryadi Kwatha	33.13	-39.82	-27.05	0.34	<i>Kapha-Pittaghni</i>
Balahathadi Tailam	-29.60	-48.66	21.73	0.57	<i>Vata-Pittaghni</i>

The results obtained from computational studies were tabulated and the discussions of comparison of the new generation medicaments with their mentioned bases or equivalent classical formulations as per the reference data given in the therapeutic index (AVS-Kottakkal) were as follows:

3.1 Rhukot Tablet

The *Rhukot* Tablet is claimed as a preparation based on the time tested classical formulation *Balaguduchyadi Kwatham* described in *Sahasrayoga* for managing pain and swelling in Rheumatoid arthritis. The text *Sahasrayoga* explains *Balaguduchyadi Kwatha* as an initial step for the preparation of *Balaguduchyadi Tailam* for pacifying the pain and inflammations of *Rakta-Pitta* disorders and further the text does not mention the therapeutic values of *Balaguduchyadi Kwatha* as a separate medicine.⁴ Here the new medicament uses the *Kundurushka* as an added ingredient which is one of the constituents of *kalka* for the classical oil preparation of the same. The computational studies revealed that the traditional *Balaguduchyadi Kwatha* belongs to *Pitta-Kaphaghni* and that of *Kottakkal* belongs to *Pittaghni* categories. The computational studies revealed that the *Rhukot* Tablet belongs to *Kapha-Pittaghni* class with a maximum possible Drug Efficacy Index value.

3.2 Rhukot Gel

It contains equal amounts of two specific oils extracted from *Cedrusdeodara* (*Devadaru*) and *Azadirachta indica* (*Neem*) trees. The adjuvant application of the gel with *Rhukot* Tablet is recommended by the manufacturer for quick relief of associated pain and swelling. The computational studies revealed that the medicament belongs to *Pitta- Kaphaghni* class with a Drug Efficacy Index value 0.22. These two classes are found complementary to each other and hence adjuvant application is recommended. The combination therapy of these two medicaments can cure the *Kapha-Pitta* vitiated type of Rheumatoid Arthritis.

3.3 Psorakot Tablet

The manufacturer claims that the basis of this medicament is the time tested classical preparation namely *Patolakaturohinyadi Kwatha* a textual formulation for skin disorders.⁵ The computational studies showed that the *Patolakaturohinyadi Kwatha* a classical formulation with a computed $Q_{(VPK)}$ value 0.59 belongs to *Pitta-Kaphaghni* class. The computational studies showed that *Psorakot* Tablet with a computed $Q_{(VPK)}$ value 0.60 also belongs to *Pitta-Kaphaghni* class. This shows that the modern medicament might also be recommended for the treatment of skin disorders originated due to *Pitta- Kaphadosha* vitiations like major disorder *Sidhma* and minor disorders like *Dadru*, *Pama*, *Visphotaka* etc. and also other minor skin disorders due to snake bites. According to the classical texts the *Kushtha* is originating due to the vitiations of all the three *doshas* and classified according to the predominantly one (*Ekadoshaja*), two (*Dwidoshaja*) or the three *doshas* (*Tridoshaja* like *Kakana*). The great *Rishis* also remember us that the *Kushthas* originated due to *Kapha-Pittadoshaja* and *Vata-Pittadoshaja* are difficult to cure. This is also evident from the computational studies as it is not easy to design a *tridoshaghni* with *Kapha-Pittaghni* or *Vata-Pittaghni* nature for curing respective skin disorders.

3.4 Psorakot Gel

It is a preparation for topical application based on the time-tested oil *Ayyappalakera tailam* for the treatment of Psoriasis.⁶ The manufacturer claims that the application of this gel in conjunction with *Psorakot* tablet helps in the effective management of the skin diseases of the type Psoriasis. The computational studies showed that *Psorakot* Gel with a computed $Q_{(VPK)}$ value 0.18 belongs to *Kapha-Pittaghni* class and the *Psorakot* Tablet with a computed $Q_{(VPK)}$ value 0.60 belongs to *Pitta-Kaphaghni* which is a complementary class. Hence the simultaneous application might enhance the therapeutic effects. The herbal medicine *Ayyappalakera tailam* (AVS-Kottakkal) for the treatment of Psoriasis with a $Q_{(VPK)}$ value 0.18 belongs to *Kapha-Pittaghni* category. The same herbal oil with a slight difference in the ingredient has a $Q_{(VPK)}$ value 0.19 also belong to *Kapha-Pittaghni* category. These studies also support that the simultaneous usage of these modern medicaments might also be recommended for the treatment of skin disorders originated due to *Pitta- Kaphadosha* vitiations like major disorder *Sidhma* and minor disorders like *Dadru*, *Pama*, *Visphotaka* etc.

3.5 Acidact Tablet

The basis of this tablet was claimed as *Puskara kwatha* referred in *Ashtangahrudayasamhita* text.⁷ The subject matters regarding hyperacidity and related ailments come under *Hrdrogacikitsa*, *Arucicikitsa*, *Trimarmeyacikitsa* etc. according to classical texts.⁸ The

sula related ailments due to hyperacidity are arising due the vitiated *Apanaprana* as a result of the food containing *kashaya*, *tikta*, *ushana* and *ruksha* type. The computational studies classified the medicament with a $Q_{(VPK)}$ value 0.40 to *Kapha-Pittaghni* category. As the peptic ulcers belong to *Kapha- Pitta* vitiation diseases rooted primarily to acidity due to the vitiation of *Pitta* the tablet might be having the claimed therapeutic values. The term *Vikartikasula* is also used in classical texts for referring the pains due to hyper acidity.

3.6 Pilocid Tablet

The manufacturer claims that this is an effective remedy for managing piles. This formulation is the combination of two classical formulations *Chiruvillwadi* and *Dusparshakadikwathams*.⁹ The computational studies classified the *Chiruvillwadi* with a $Q_{(VPK)}$ value 0.95 to *Vata- Kaphaghni* category and *Dusparshakadi* with a $Q_{(VPK)}$ value 0.55 to *Pitta-Kaphaghni* category. The studies classified modern medicament *Pilocid* Tablet with a $Q_{(VPK)}$ value 0.69 to *Pitta-Kaphaghni* category. The internal haemorrhoids are *Ardrarsa (Pitta-kaphatmaka)* and the external haemorrhoids are the *Sushkarsa (Vata-kaphatmaka)*. The *Chiruvillwadi* is advisable for *Sushkarsa* the non-bleeding external haemorrhoids. The *Dusparshakadi* is also not indicated in bleeding condition as it contains dry gingers (*Nagara*). The bleeding conditions were managed with various proportional combinations of these two *kwathas* with slight changes in the compositions. The traditional practitioners have the right to change the composition of a formulation by considering the nature (*prakrti*) of *Rogi* and nature (*vikrtisvabhava*) of *Roga*. *Dusparshakadi kwatha* without the component *Nagara* is advisable for managing the bleeding piles (*Ardrarsa*). Computational studies also supported the same as it retains its *Pitta-Kaphaghni* nature but with a slightly lower $Q_{(VPK)}$ value 0.50. Even though the *Pilocid* Tablet belongs to the *Pitta-Kaphaghni* category it alone might not be advisable for bleeding conditions as it contains the dry gingers. This shows the urgent need to modify the modern medicament *Pilocid* Tablet by altering the components with and without *Nagara* for the claimed clinical efficacies.

3.7 Pilocid Gel

This is gel for external application for arresting the bleeding and thus managing bleeding piles. The computational studies revealed that the *Pilocid* Gel with a $Q_{(VPK)}$ value 0.63 to *Kapha-Pittaghni* category and thus supported the claims to manage bleeding internal haemorrhoids or *Ardrarsa (Pitta-kaphatmaka)*. Thus, it might helpful in effectively managing the bleeding piles in combination with modified *Pilocid* Tablets.

3.8 Livokot Tablet

It is a unique modern herbal combination having hepatoprotective functions that help in the treatment of liver disorders. The computational studies revealed that the *Livokot* Tablet with a $Q_{(VPK)}$ value 0.25 to *Kapha-Pittaghni* category. The manufacture claims that it could be fruitful for treating various liver disorders including Jaundice. Traditionally the disease Jaundice is classified as *Kamala* which can be divided mainly to three viz. *Kostagatakamala* (~Hepatocellular), *Sakagatakamala* or *Ruddhakamala* (~Obstructive) and *Paratantrakamala* (~Haemolytic). In the first type the vitiation of *Pitta* and *Rakta*, in second variety the flow of *Pitta* is obstructed by *Kapha*, and in the third arises due to the imbalances of *Pitta* as a result of food habits. The computational studies showed that the *Livokot* Tablet being *Kapha-Pittaghni* category it might be more fruitful for managing Obstructive type of Jaundice (*Ruddhakamala*).

3.9 Migrakot Tablet

This is a modern medicament prepared based on the classical formulation of *Pathyakshadhatryadi Kwatha* to treat the migraine.¹⁰ The computational studies revealed that the *Migrakot* Tablet with a $Q_{(VPK)}$ value 0.34 to *Kapha-Pittaghni* category and also the classical formulation *Pathyakshadhatryadi Kwatha* with a $Q_{(VPK)}$ value 0.34 to *Kapha-Pittaghni* category. The migraine is believed to be *Pittaja* in nature. The studies supported the modern medicament might be effective for managing Migraine of *Pittaja* type.

3.10 Migrakot Oil

This is a modern formulation based on the classical oil *Balahathadi tailam* for treating various types of headaches.¹⁰ The computational studies revealed that the *Migrakot* Oil with a $Q_{(VPK)}$ value 0.57 to *Vata-Pittaghni* category and also the classical formulation *Balahathadi*

tailam with a $Q_{(VPK)}$ value 0.57 to *Vata-Pittaghni* category. The treatment of migraine that based on the principles to pacify the vitiated *Vata* and *Pitta* to balance *Kapha* might be effective.

3.11 Ostikot Tablet

This is preparation based on the time tested classical formulation *Rasnasaptakam Kwatham* for managing pain and swelling in Osteo arthritis.¹¹ The computational studies revealed that the *Ostikot* Tablet with a $Q_{(VPK)}$ value 0.76 to *Pitta-Kaphaghni* category and also the classical formulation *Rasnasaptakam Kwatham* with a $Q_{(VPK)}$ value 0.70 to *Pitta-Kaphaghni* category. The ayurveda classified Osteo arthritis as a disease due to the vatadoshaprakopa in Kaphasthana. The usual treatments could be of two types for treating viz. *Vata-Kapha* and *Vata-Pitta* conditions. The classical formulation *Rasnasaptakam Kwatham* is usually administered with powdered dry gingers (*Nagara*) as a *prakshepadravya* while treating the various conditions of arthritis. The classical formulation *Rasnasaptakam Kwatham* with *Nagara* improves the $Q_{(VPK)}$ value to 0.81 and even to 1.00, and to *Pitta-Kaphaghni* and even to *Tridoshaghni* natures by decreasing the *Vata* component. So, the modern medicament might give good results by altering the components according to the classical principles.

3.12 Respikot Tablet

It is modern formulation prepared based on classical *Dasamulakatutrayadi Kwatha* for managing bronchial asthma and other respiratory tract disorders.¹² The computational studies revealed that the *Respikot* Tablet with a $Q_{(VPK)}$ value 0.45 to *Pitta-Kaphaghni* category and also the classical formulation *Dasamulakatutrayadi Kwatha* with a $Q_{(VPK)}$ value 0.45 to *Pitta-Kaphaghni* category. The *prakshepa* honey to this *kwatha* alters the category to *Kapha-Pittaghni* a complementary category. Thus, the modern medicament might manage the respiratory diseases due to the vitiation of *Pitta* and *Kapha* on a combinational therapy using other medicaments.

4. CONCLUSION

This paper computed and compared the Drug Efficacy Indices of various modern medicaments and their classical bases. The studies revealed the effective management of claimed diseases by certain medicaments and pointed the need of improvisation of the medicaments like *Pilocid* Tablet. The efficacies of *Ayurvedic* formulations not only classical formulations but also modern medicaments can be computed and predicted successfully. This could be considered as the very bases of Drug Discovery processes of *Ayurveda* system. The studies also supported the need of methodologies developed based on the classical concepts for the fruitful researches in the field of drug discovery processes of *Ayurveda* system. More researches are going on to develop full featured clinical software for the use of *Ayurveda* researchers, practitioners and lovers of *Ayurveda*. When interrogate in deep it is excitingly wonderful to know that the very founders of *Ayurveda* system used many powerful methodologies that have more importance in the field of computer aided drug discovery processes.

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