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Performance Measures of The Homeopathic Medications In Curing The Thyroid Hormone Disorders Using M/M/4 Transient Queueing Model

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ABSTRACT

The thyroid gland secretes two hormones that are released into blood. These hormones are necessary for all the cells in body to work normally. The over secretion or under secretion of these hormones causes changes in metabolism of the body cells. In this paper we consider M/M/4 queueing system with heterogeneous servers subject to catastrophes as our base model and with the aid of our model, we are analyzing homeopathic-medicine which will balance the hormonal level and thereby find the best drug to cure the disorders in transient-state and in steady-state.

KEYWORDS: Hypothyroidism, Hyperthyroidism, Thyroid hormone receptors, Thyroid-Stimulating Hormone (TSH), Transient-state solution and Steady-state solution.

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INTRODUCTION

The thyroid gland is an endocrine gland in neck. The thyroid gland secrete two hormones that are released into blood: *Thyroxine*(*T4*) and *Triiodothyronine*(*T3*). The hormone releases from the thyroid gland is maintained by *thyroid-stimulating hormone*(*TSH*) which is regulated from the *Anterior Pituitary Gland*, which itself is controlled by *thyrotropin-releasing hormone*(*TRH*) produced by the *Hypothalamus*. These hormones which is biologically active and governs the metabolism of body cells. In other words, it controls the speed with which body cells work. If the hormones are secreted more than normal subsequently the body cells works faster than normal, which shows *Hyperthyroidism*. If too little of the thyroid hormones are produced, then the cells and organs of body slow down its activity, which indicates *Hypothyroidism.*

Receptors function as *hormone-activated transcription factors*. Mammalian thyroid hormone receptors are encoded by two gene, designated alpha and beta. Further, the primary transcript for each gene can be alternatively spliced, generating different alpha and beta receptor isoforms. Currently, four different thyroid hormone receptors are recognized: *alpha-1, alpha-2, beta-1, and beta-2*.

NUMERICAL SOLUTION

Models in Queueing System, are developed by differential equations with respect to time in case of Transient Analysis and differential equations with independent on time(time=0) in case of Steady-State Analysis. In order to find numerical solutions to ordinary differential equations, few numerical methodologies can be utilized to obtain values. For example, *Runge-Kutta method*, Euler's method and Boundary Value method.

The relationship between insulin level and number of insulin receptors has studied with application of queueing theory logic by C.Kandemir and L.Cavas [3]. From a textbook of receptor pharmacology, drug- receptor interaction has detailed by Jenkinson.D.H [4] in classical view. Kenakin.T [5] analyzed the interaction of drug and receptor in pharmacologic view-point. A numerical approach to queueing system has discussed by A.Nellai Murugan and S.Vijayakumari Saradha [6]. A combined analysis of queues with heterogeneous servers subject to catastrophes to find transient solution of an M/M/2 model by Kumar.B.K, Pavai.M and Vankatakrihnan [1]. Where a Transient M/M/4 queueing model with heterogeneous servers subject to catastrophes has discussed by Julia Rose Mary. K and Maria Remona. J [2]. Analysis on calculating numerical values to differential equations where done by Shyam sundar Sah and Ram Prasad Ghimire [7].

Relating the *four different thyroid hormone receptors with four heterogeneous servers* of the considered queueing model, the rate of behavior of drugs in the receptors can be analyzed. *Runge-*

Kutta methodology is utilized to calculate the required numerical values to the data. Further, in this paper we examine Homeopathic treatment and moreover we are analyzing which drug is the best one for thyroid disorders.

BASIC ELEMENTS

The Queueing model, "Transient Solution of a M/M/4 Queue with Heterogeneous Servers subject To Catastrophes" is considered as a basic concept for this paper. The idea is to replace the four heterogeneous servers of the queueing model to be the four thyroid hormone receptors bind DNA. Thyroid gland failure or malfunctions of brain or heart or etc., are subject to be the catastrophes. The arrival in the system is nothing but the drugs which is consumed to deal with thyroid hormone disorders. The basic elements of the performance measures of our queueing system is considered as follows,

$L_q \rightarrow$ Expected level of drug absorbed by the receptors.

$L_s \rightarrow$ Expected level of TSH absorbed in DNA.

$W_q \rightarrow$ Expected level of drug lingers by the receptor.

$W_s \rightarrow$ Expected level of TSH required in DNA after the reaction of drug.

TRANSIENT-STATE SOLUTION

The performance measures of transient-state equations of finite servers are considered and by taking c=4 for our model. Thus, various performance measures are

$$L_q = \sum_{n=c+1}^{\infty}(n-c)\mathrm{P}_n \qquad L_s = L_q + \frac{\lambda}{\mu} \qquad W_q = \frac{L_q}{\lambda} \qquad W_s = \frac{L_s}{\lambda}$$

The value of Expected level of drugs absorbed by the receptors and Expected level of TSH absorbed in DNA are expected to be higher will produce good improvement in health. Then the values of Expected level of drug linger by the receptors and Expected level of TSH required in DNA after the reaction of drug should be low in level for the best result.

STEADY-STATE SOLUTION

The basic measures of performance of steady-state process are considered as below,

$$L_q = \frac{\lambda\mu\left(\lambda/\mu\right)^c \mathrm{P}_0}{(c-1)!\,(c\mu-\lambda)^2} \qquad L_s = L_q + \frac{\lambda}{\mu} \qquad W_q = \frac{L_q}{\lambda} \qquad W_s = \frac{L_s}{\lambda}$$

where $\mathrm{P}_0 = \left[\sum_{n=0}^{c-1}\frac{1}{n!}\left(\lambda/\mu\right)^n + \frac{1}{c!}\left(\lambda/\mu\right)^c \frac{c\mu}{c\mu-\lambda}\right]^{-1}$

Steady-state are all about $\rho\left(=\frac{\lambda}{\mu}\right)$, i.e., traffic intensity, thus in this case the minimum values shows to be more effective. Thus, the values of Expected level of drugs absorbed by the receptors, Expected level of TSH absorbed in DNA, Expected level of drug linger by the receptors and Expected level of TSH required in DNA are expected to be low in range.

HOMEOPATHIC MEDICATION

Homeopathy is a system of alternative medicine created in 1796 by a German Physician Samuel Hahnemann, based on his doctrine of "like cures like", he claims that a substance that causes the symptoms of a disease in healthy people would cure similar symptoms in sick people. Homeopathy is a *pseudoscience* (i.e., incorrectly presented as scientific).

The most prescribed homeopathic drugs are stated below. Homeopathy can cure diseases by providing complete physical, mental and spiritual health in almost all cases except in emergency.

Hypothyroidism-Drugs	**Hyperthyroidism-Drugs**
Calcarea Phosphorica	Conium Maculatum
Lycopus	Lodium
Lapis-albus	Lachesis Mutus
Thyroidinum	Natrum Muriaticum

Numerical Solution-Hypothyroidism

The drug contains man-made hormones to maintain the thyroid hormones in equilibrium level. In case of hypothyroidism, the synthetic hormones in the drug should increase the hormonal level. The level of drugs accepted by the four receptors is taken as service rates. The level of drug actually intake by the patient is considered as arrival rate. The occurrence level of catastrophes and the initial probability $[P_0(0)]$ are always constant. Using Runge-Kutta 4^{th} order, the numerical values of the reaction of receptors towards the drugs is calculated for each drug separately and the values are tabulated below.

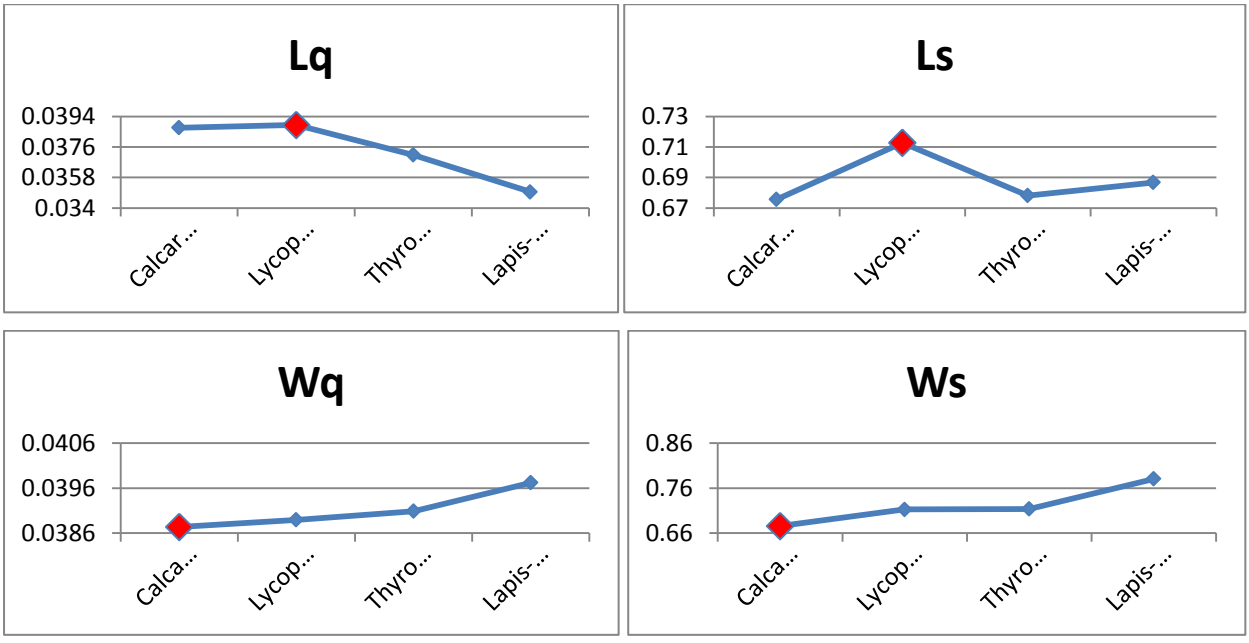
Drugs	Calcarea Phosphorica	Lycopus	Thyroidinum	Lapis-albus
$P_0(0.1)$	0.55185845	0.55245478	0.55412005	0.55983906
$P_1(0.1)$	0.39515781	0.41638151	0.39652293	0.40159445
$P_2(0.1)$	0.14210254	0.15988954	0.14432780	0.14702762
$P_3(0.1)$	0.03096435	0.03597052	0.03139032	0.03278818
$P_4(0.1)$	0.00442918	0.00514422	0.00440879	0.00503107
$P_5(0.1)$	0.00430654	0.00449657	0.00418637	0.00403928
$P_6(0.1)$	0.00409147	0.00407667	0.00386322	0.00357853
$P_7(0.1)$	0.00375463	0.00375462	0.00360809	0.00339924
$P_8(0.1)$	0.00374605	0.00374512	0.00359936	0.00338983

Table-1

Transient-State Solution

Transient-state (Dependent on time) values are calculated with the aid of Table-1 and the values are tabulated. The calculated values of L_q, L_s, W_q and W_s for each drug represent the behavior of drug towards the thyroid hormone receptors.

Drugs	L_q	L_s	W_q	W_s
Calcarea Phosphorica	0.03873755	0.67568023	0.03873755	0.67568023
Lycopus	0.03889426	0.71274871	0.03889426	0.71274871
Thyroidinum	0.03713455	0.67816019	0.03908901	0.71385284
Lapis-albus	0.03495338	0.68680523	0.03971975	0.78046049



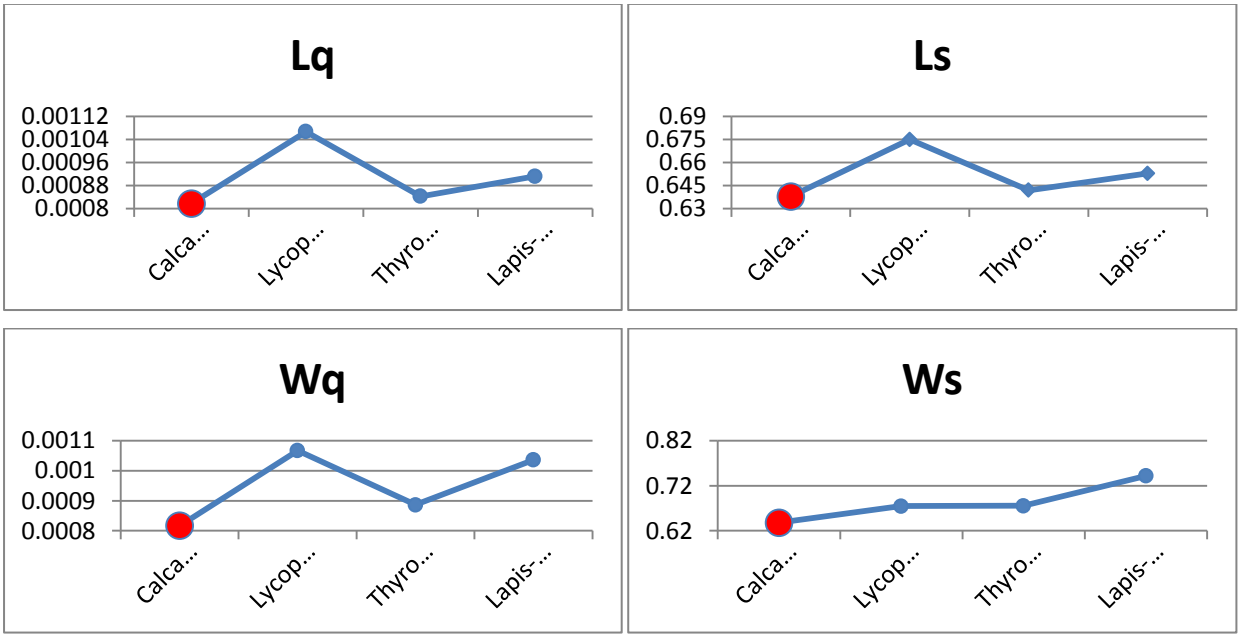
The absorption level of the drug increases in transient-state (time-dependent state). If more the absorption level (L_q *and* L_s) increases, thereby we observe that there is good improvement in balancing the hormones. Thus, the drug Lycopus shows maximum value in absorption by the receptors. When the absorption is more the requirement for balancing hormones (W_q *and* W_s)in

receptor decreases. So, the least value of requirement of hormones is found to be in Calcarea Phosphorica but since the value of Calcarea Phosphorica in L_s is very low, we neglect this drug. Thus, the second lowest value of W_q *and* W_s is observed in Lycopus and finally we select the **Lycopus** to be the best drug to cure hypothyroidism in transient-state.

Steady-State Solution

By using of Table-1, Steady-state(independent on time state) values are calculated and then tabulated below. The values of L_q, L_s, W_q and W_s for each drug shows the behavior of drug towards the receptors.

Drugs	L_q	L_s	W_q	W_s
Calcarea Phosphorica	0.00081693	0.63775961	0.00081693	0.63775961
Lycopus	0.00106671	0.67492116	0.00106671	0.67492116
Thyroidinum	0.00084205	0.64186769	0.00088637	0.67565029
Lapis-albus	0.00091160	0.65276345	0.00103591	0.74177665



Since the steady-state means independent on time and also it is calculated with the values of ρ (traffic intensity). The levels of interfering the reaction to the receptor are calculated. So, the minimum value of L_q, L_s, W_q and W_s in steady-state condition is clearly found which is **Calcarea Phosphorica**, this drug shows best result in steady-state condition.

Numerical Solution-Hyperthyroidism

In case of hyperthyroidism, the drug should reduced the production of excess thyroid hormones and thus to control the hormone level in equilibrium. The service rates, arrival value,

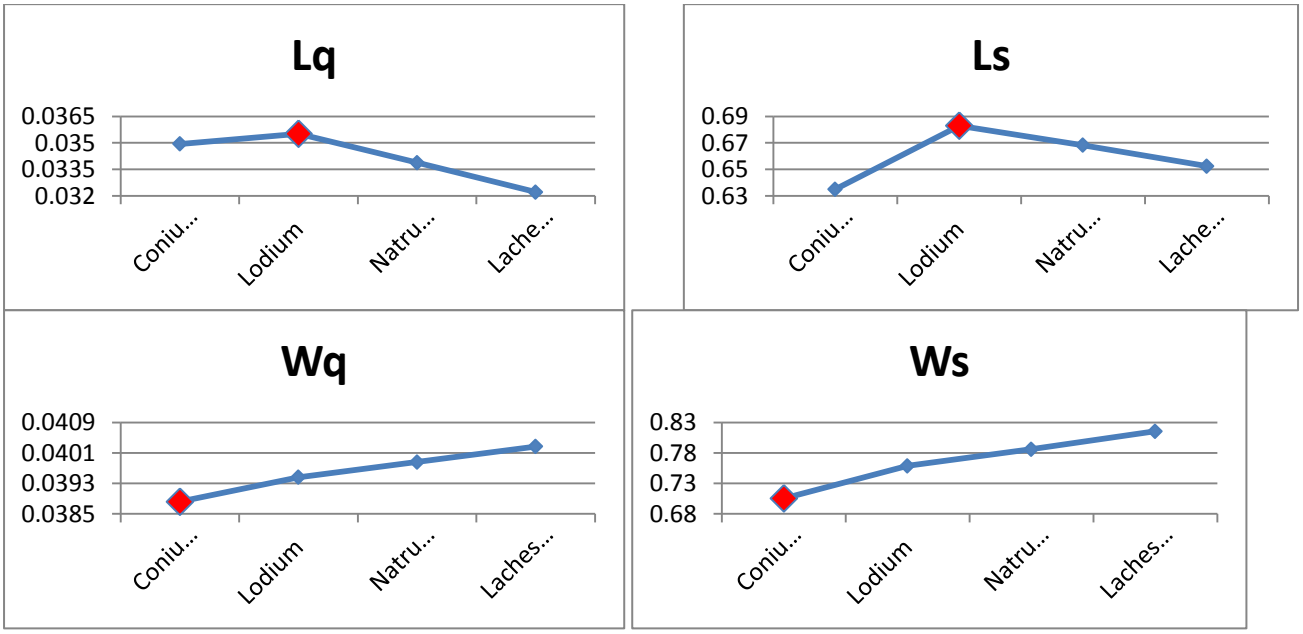
catastrophes and initial probability are all same as considered in case of hypothyroidism. Numerical values are also found in same methodology and the values are tabulated.

Drugs	Conium Maculatum	Lodium	Natrum Muriaticum	Lachesis Mutus
$P_0(0.1)$	0.55691104	0.55909144	0.56021327	0.56463293
$P_1(0.1)$	0.37148478	0.39914093	0.39059117	0.38165639
$P_2(0.1)$	0.12712709	0.14607876	0.14003625	0.13257810
$P_3(0.1)$	0.02624060	0.03219082	0.03041115	0.02854415
$P_4(0.1)$	0.00371961	0.00479336	0.00472859	0.00453171
$P_5(0.1)$	0.00367286	0.00407526	0.00392758	0.00365498
$P_6(0.1)$	0.00354501	0.00363197	0.00342021	0.00326504
$P_7(0.1)$	0.00345661	0.00345934	0.00330653	0.00315073
$P_8(0.1)$	0.00345104	0.00345024	0.00329875	0.00314417

Table-2

Transient-State Solution **:** the following table values are calculated with the aid of table-2.

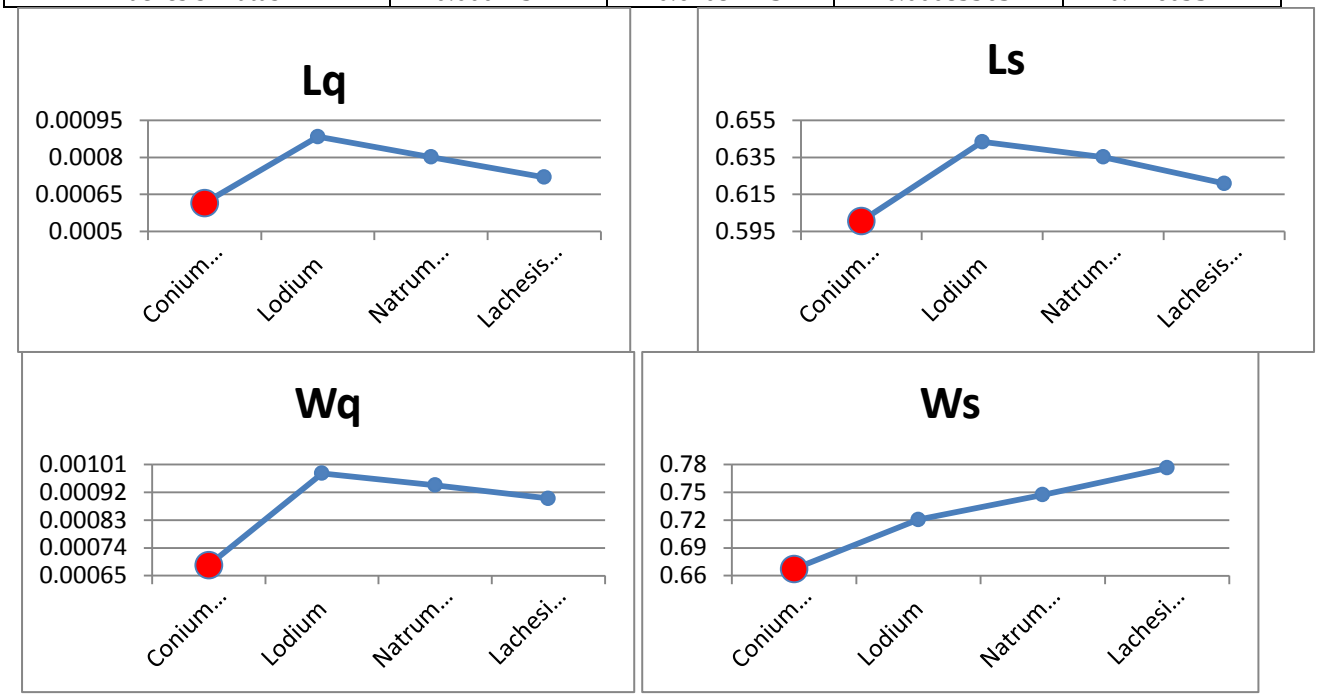
Drugs	L_q	L_s	W_q	W_s
Conium Maculatum	0.03493688	0.63493688	0.03881875	0.70548543
Lodium	0.03551823	0.68300024	0.03946470	0.75888916
Natrum Muriaticum	0.03388263	0.66821098	0.03986191	0.78613056
Lachesis Mutus	0.03221393	0.65236897	0.04026742	0.81546121



From the graph and table, the values of L_q and L_s are seem to be high in Lodium and also second lowest in values in W_q and W_s. So it's advisable to treat hyperthyroidism with Lodium for the best improvement in health.

Steady-State Solution **:** with the aid of Table-2, the values below are calculated and tabulated.

Drugs	L_q	L_s	W_q	W_s
Conium Maculatum	0.00061519	0.60061519	0.00068442	0.66735022
Lodium	0.00088301	0.64836503	0.00098113	0.72040558
Natrum Muriaticum	0.00080115	0.63512951	0.00094253	0.74721194
Lachesis Mutus	0.00071972	0.62087475	0.00089965	0.77609344



On observing the tabulated values and line chart, the values of L_q, L_s, W_q and W_s are likely lower for the drug Conium Maculatum. Hence it's clear that the drug Conium Maculatum being good result in curing the hyperthyroidism.

Since because, the transient-state solutions shows satisfying result than the steady-state solutions basically. The drugs Lycopus for under-active thyroid and Lodium for over-active thyroid are more satisfying in their effectiveness of rectifying thyroid hormonal disorders.

CONCLUSION.

Hence fore, this chapter was about curing thyroid hormone disorders with homeopathic medicines in application to the M/M/4 queuing model. The transient-state and steady-state values are calculated and the derived values are plotted as line graphs. With the help of those numerical solutions the best medications for hypothyroidism and hyperthyroidism have analyzed. At last the best treatments to be followed to cure thyroid disease have been stated.

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