

## Epidemiological study for *Trichomonas Vaginalis* for Discrete time model and Continuous time model

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### -----ABSTRACT-----

During the period of July until December 2017 Conduct an epidemiological study to investigate the prevalence of *Trichomonas Vaginalis* among women who have been consulted for the consultation and emergency of the maternity and child hospital in Diwaniyah city in Iraq. The number of specimens examined was 857 samples and the ages ranged between 15-60 years. After the swabs were taken, the direct examination and coloring and planting on the different food communities to diagnose parasitic *Trichomonas vaginalis* the incidence of *Trichomonas vaginalis* was 129 (17%). Using the mathematical model discrete time model and continuous time model, it was observed that the highest percentage of infection was in July and the disease began to fade until it reached the lowest rate in December. Using the mathematical model mentioned above, it was noted that teaching a significant role in curbing the spread of the disease.

**KEYWORD:** Discrete time model, Continuous time model, deference equations, biological models, disease models, corresponding rate, *Trichomonas Vaginalis*.

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### I. INTRODUCTION

*Trichomonas vaginalis* additionally called trichomoniasis will be a standout amongst the commonest sexually transmitted pathogens in the planet for an evaluated 174 million situations happening every year [33]. It may be a significantly a greater amount common sexually transmitted spoiling over Possibly chlamydia trachomatis or *Neisseria gonorrhoeae*, yet Previously, glaring difference little consideration will be paid to trichomoniasis [26]. In the United States, it might have been as of late assessed that 5 million new cases show up yearly [27,33,7,10] compared with 3 million cases for chlamydia Also 650 000 situations about gonorrhea yearly. Those the study of disease transmission of the ailment may be at present poorly seen Furthermore A percentage professionals proceed with with inquiry its essentialness [3]. *Trichomanas vaginalis* is that's only the tip of the iceberg predominant to females (67%–100% female sexual accomplices of contaminated mamoncillo get infected) over for guys (14%–60% about male sexual accomplices for a contaminated lady get infected) [35,16,13]. Those reason the reason females would All the more contaminated is poorly understood, In spite of a few. Specialists [17,9] surmise those prostatic liquid holds zinc Furthermore different substances destructive of the pathogen. To females trichomoniasis may be connected with vaginal discharge, vaginal itching, torment at urinating Also dependent upon one third for ladies don't show manifestations [15]. In spite of the greater part guys don't demonstrate indications identified with *Trichomanas vaginalis* infection, a few do knowledge urethral discharge, torment the point when urinating and swelling of the scrotum [15].

Typically, medicine comprises for metronidazole and tinidazole. Left untreated incessant *Trichomanas vaginalis* infections might prompt difficulties including: pelvic incendiary disease, premature delight for membranes, low-birth-weight infants, pre-term conveyance Also abortion [29,21,5]. Cudmore What's more Garber [8] indicated that the improvement of a immunization against *Trichomanas vaginalis* Might lessen the human costochondritis (pregnancy complications, infertility), therapeutic costochondritis What's more expanded powerlessness should hiv Also societal fetches. It need been demonstrated that *Trichomonas vaginalis* infections prompt an expansion in the danger from claiming transmitting hiv two-fold [18,11,21,14]. Malaria, Tuberculosis, hepatitis B, Hiv/aids What's more different sexually transmitted infections have at constantly mathematically accounted for (see [28,2,24,31,22,25,38] should notice barely a couple of them). Exactly as of late exactly creators [3,8,34,19] destroyed investigate exactly all sir Also SEIRS models for intriguing Progress. Those after the fact [19] completed investigate SEIRS model incorporating different irresistible phases. In spite of *Trichomanas vaginalis* being an of age spoiling which is even now influencing humankind no scientific record for it need been

conveyed out to those best learning of the writers. [1,2] Attempt to give mathematical analysis of it taking into consideration effects of differential infectivity patterns between males and females as well as between lesbians and non-lesbians. Of the best of the creator this might be the to start with composition with research these parts.

**Some basics of mathematical biology:** This science refers to the overlap of two areas (the application of computational mathematics and life sciences). The biological models provide endless processing of interesting nonlinear problems. The mathematical model describes the interplay between biological components, computer model analysis and the application of mathematics allows us to infer and infer the result of interference. An example of this is the data on voltages based on the movement of electrical ions through the neurotransmitter in the electroplating models. The output predicts the dynamics of electrical activity in the nerves, the behavior and survival of newly infected people are placed in disease models and the outcome is predicting when and where the disease will spread and how it can be controlled.

## II. MODEL DESCRIPTION

If we know that the society consists of three types of individuals: sensitive to the disease (healthy), infected and exposed and the relationship between them is illustrated in the diagram below:

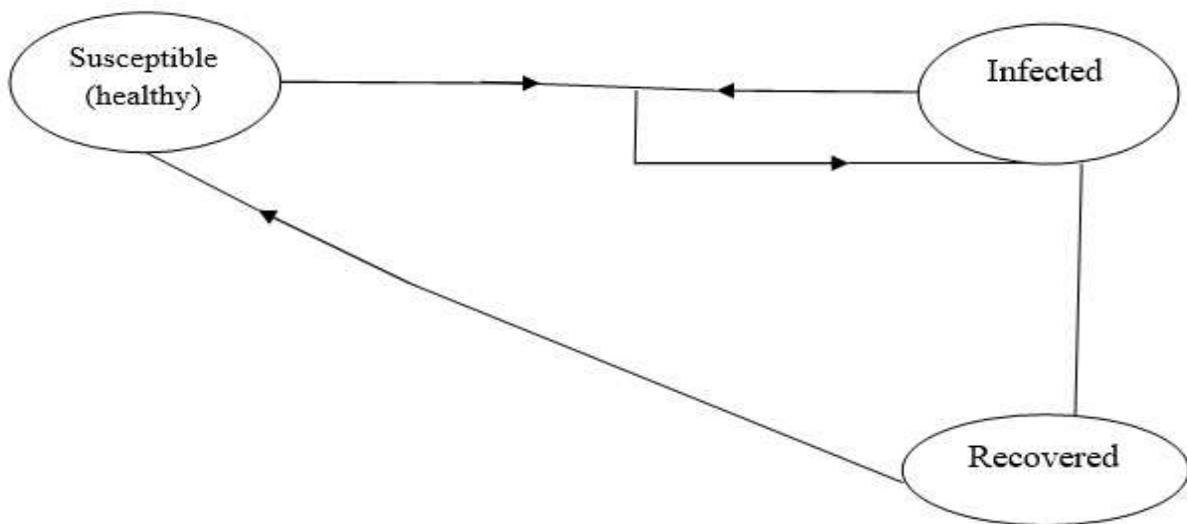


Figure (1) Arrow diagram for a simple epidemic model, showing the relationship between the classes of susceptible, infected, and recovered individuals.

Observe through Figure 1 that individuals can become sensitive again. In this case, we can believe that individuals who are exposed have temporary immunity to the disease. And return to the category of those sensitive to the disease in case of temporary immunity.

In order to create a model for this situation, we need to quantify this diagram. To do that, we follow these three steps:

1. The dependent variable is the number of infected individuals, I.
2. As time progresses, infected individuals recover. Thus, the independent variable is time t.
3. The rate  $\alpha$  is independent of the time unit chosen, whereas the probability depends on the chosen time unit.

$$\alpha = \frac{p}{\text{unit of time}} = \frac{p_{\Delta t}}{\Delta t} \tag{1}$$

Where  $\alpha$  is constant for all values of  $\Delta t$ , we can take the limit as  $\Delta t \rightarrow 0$ .

## III. DISCRETE-TIME MODEL DESCRIPTION

In this model we use a simple differential equation called the equation of differences depending on the source [2].we have specify a time unit, say  $\Delta t = \frac{1}{2} \text{day}$  Then  $p_{\Delta t} = p_{\frac{1}{2}} = \alpha \cdot \frac{1}{2} \text{day}$

$$I(t + \Delta t) = I(t) - p_{\Delta t} I(t) \tag{2}$$

Where  $t\Delta$  is the collocation of the unit of time and we can solve eq.(2) by simplifying the equation we get:  
Let  $B^n = I_n$

$$B^{n+1} = \left(1 - p_{\frac{1}{2}}\right) B^n$$

$$B^{n+1} - \left(1 - p_{\frac{1}{2}}\right) B^n = 0$$

$$B^n \left[ B - \left(1 - p_{\frac{1}{2}}\right) \right] = 0$$

$$\text{Since } B^n \neq 0 \text{ then } B - \left(1 - p_{\frac{1}{2}}\right) = 0$$

$$\text{That is } B = \left(1 - p_{\frac{1}{2}}\right) \text{ since } B^n = I_n$$

$$\text{One can get } B^n = \left(1 - p_{\frac{1}{2}}\right)^n$$

The general solution is

$$I_n = c \left(1 - p_{\frac{1}{2}}\right)^n$$

$$\text{To find } c \text{ let } n=0 \text{ then } n=0, I_0 = c \left(1 - p_{\frac{1}{2}}\right)^0$$

$$\text{Thus } c = I_0 \Rightarrow I_n = I_0 \left(1 - p_{\frac{1}{2}}\right)^n$$

We will get

$$I_n = I_0 \left(1 - p_{\frac{1}{2}}\right)^n \quad n \geq 1 \tag{3}$$

After applying equation (3) to the data given and using the Matlap Microsoft program, the results were obtained in Table (1) as well as the graphs representing the monthly changes of the disease.

Table 1: Monthly changes in trichomonas vaginalis

High education	Secondary education	Elementary Education	Illiteracy (Without education)	Positive sample	month
6.0000	17.0000	43.0000	63.0000	129.0000	July
3.0000	8.5000	21.5000	31.5000	64.5000	august
1.5000	4.2500	10.7500	15.7500	32.2500	September
0.7500	2.1250	5.3750	7.8750	16.1250	October
0.3750	1.0625	2.6875	3.9375	8.0625	November
0.1875	0.5313	1.3438	1.9688	4.0313	December

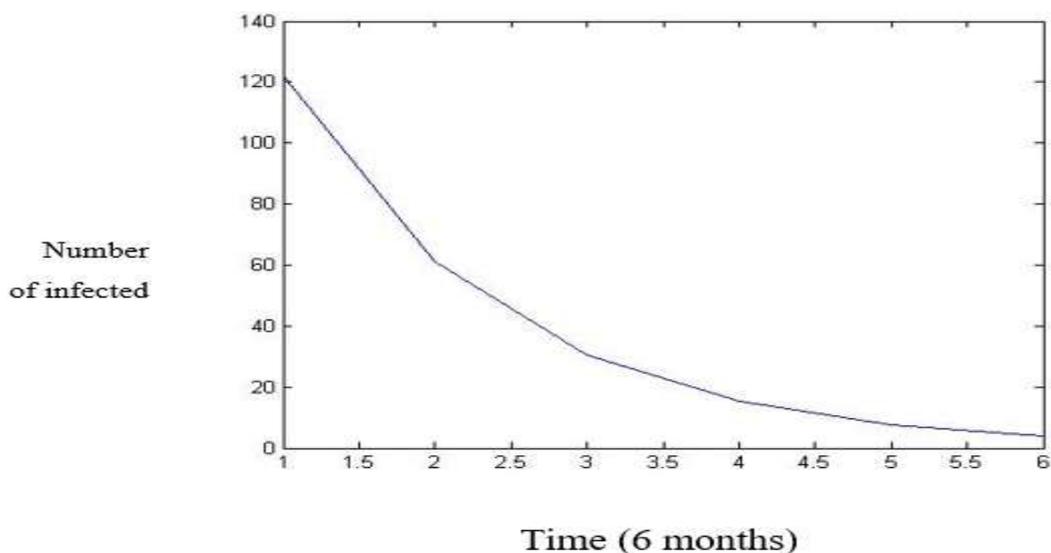


Figure (2) monthly changes of the disease for positive samples

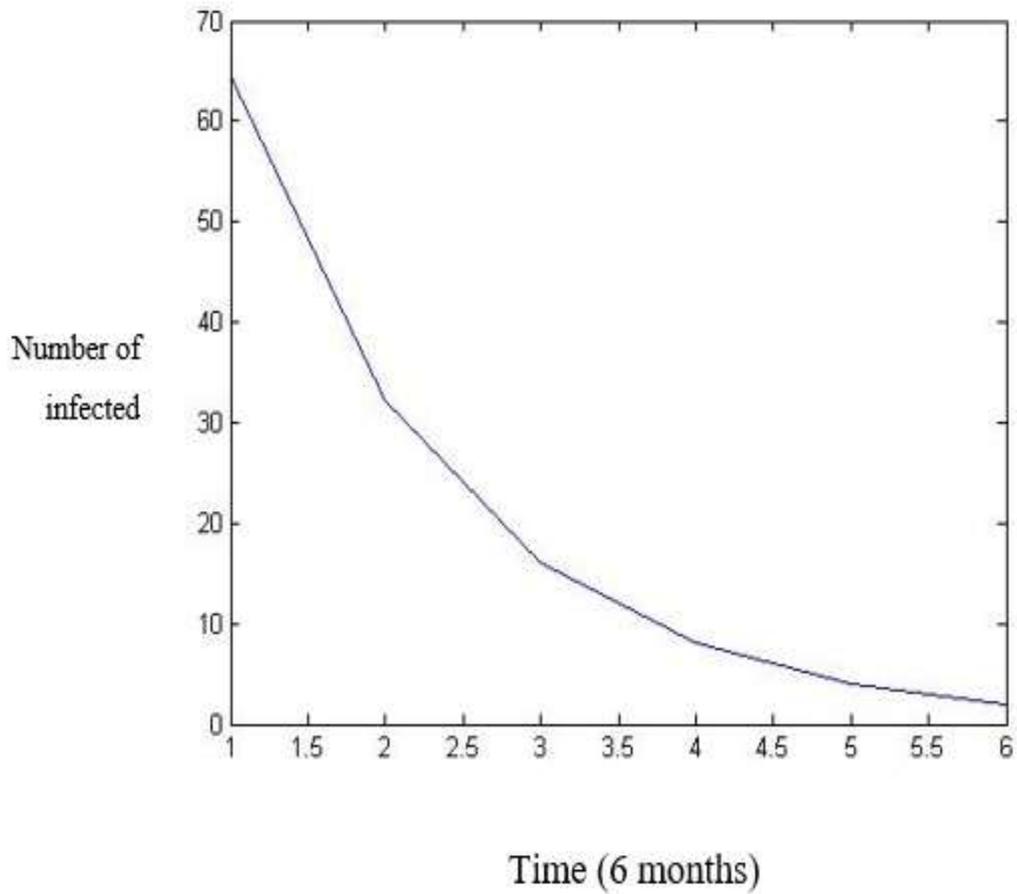


Figure (3) Monthly changes of the disease for Illiteracy

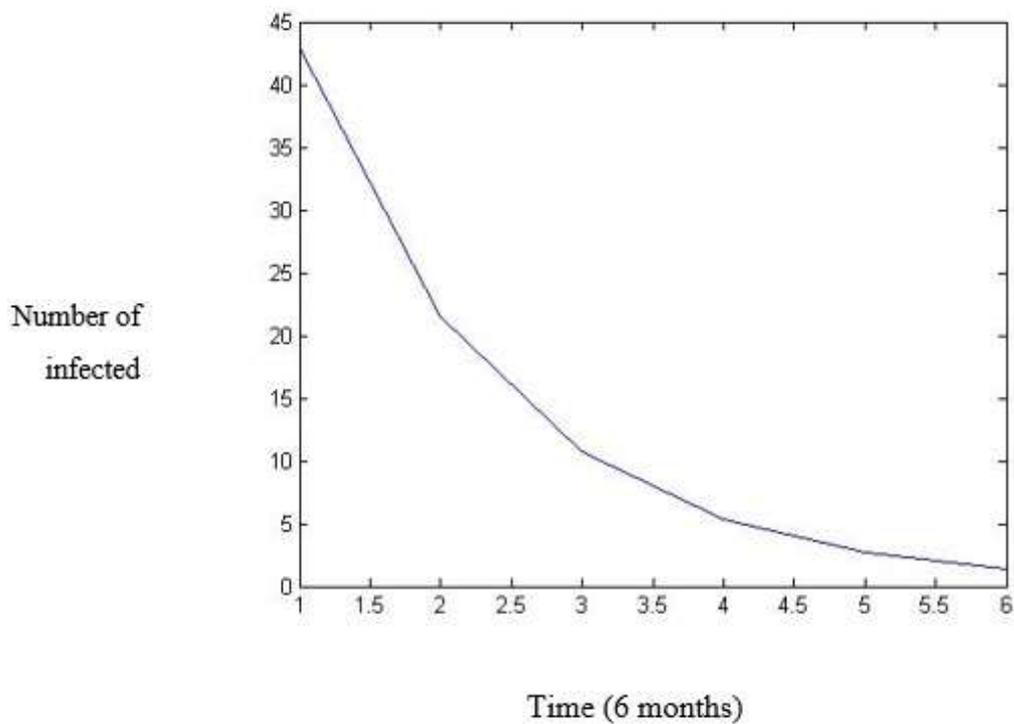


Figure (4) Monthly changes in the disease for individuals with primary education

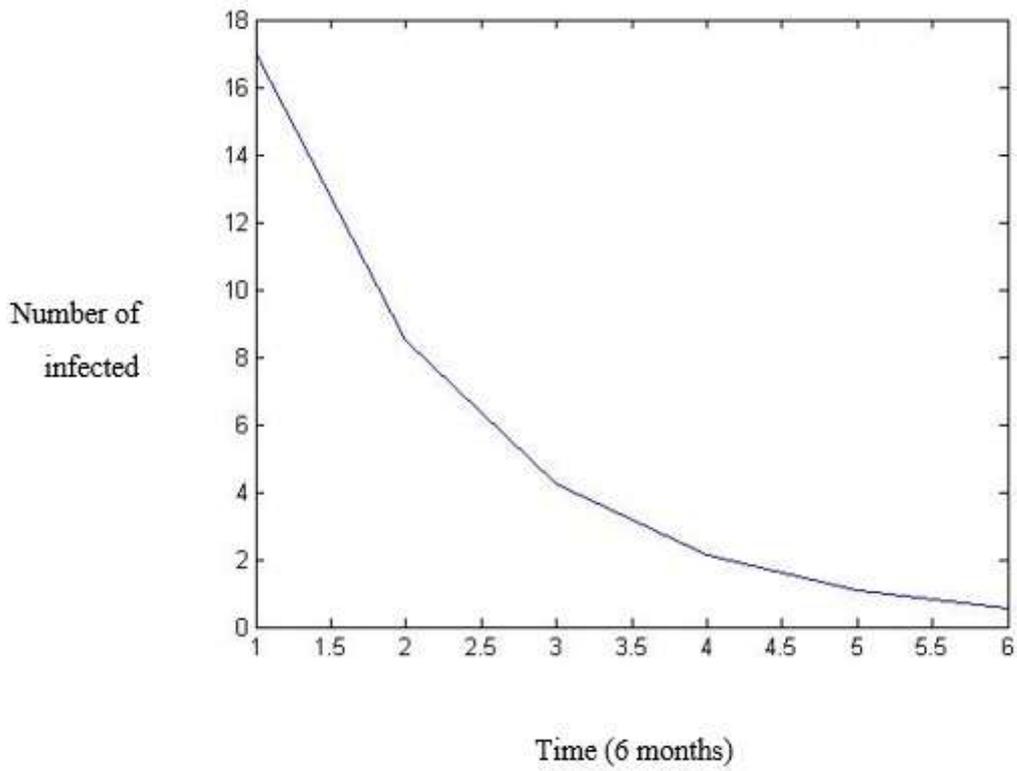


Figure (5) monthly changes in the disease for individuals with secondary education

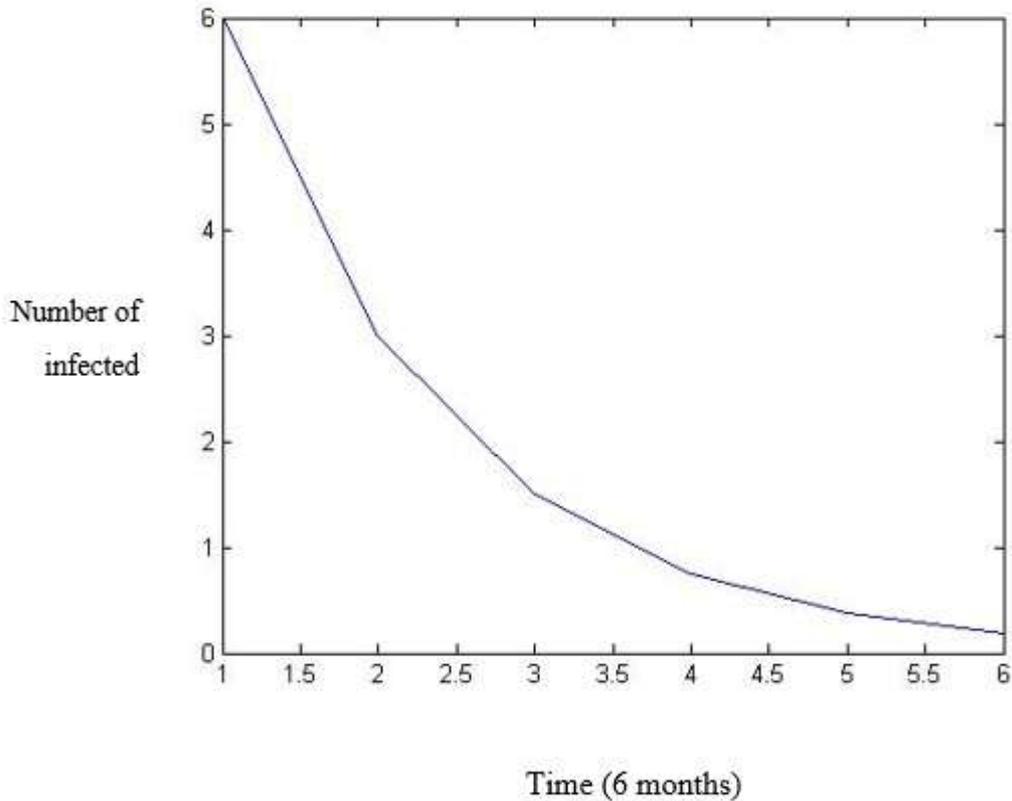


Figure (6) monthly changes in the disease for individuals with higher education

**IV. CONTINUOUS-TIME MODEL**

In this model we depending on the referee [2] by use differential equation

$$\frac{d}{dt}I(t) = -\alpha I(t) \tag{4}$$

To solve this simple difference equation, we will take the integration to both said of equation (4) hence one can get

$$\int_t \frac{dI(t)}{I(t)} = \int_t -\alpha dt$$

$\ln I(t)|_0^t = -\alpha t|_0^t$  replies  $\ln I(t) - \ln I(0) = -\alpha t$  and  $\ln \frac{I(t)}{I(0)} = e^{-\alpha t}$  so one can have  $I(t) = I(0)e^{-\alpha t}$

Where the general solution is

$$I(t) = I_0 e^{-\alpha t} \tag{5}$$

After applying the equation (6) to the data given and using the Matlap Microsoft program, the results were obtained in Table (2) as well as the graphs representing the monthly changes of the disease.

Table (2) Monthly Changes in *Trichomonas vaginalis*

High education	Secondary education	Elementary Education	Illiteracy (Without education)	Positive sample	month
11.0774	31.3860	79.3880	116.3127	238.1640	July
9.4395	26.7453	67.6500	99.1151	202.9500	august
7.4254	21.0386	53.2154	77.9667	159.6461	September
5.3919	15.2772	38.6423	56.6154	115.9269	October
3.6143	10.2406	25.9027	37.9505	77.7081	November
2.2365	6.3367	16.0282	23.4831	48.0845	December

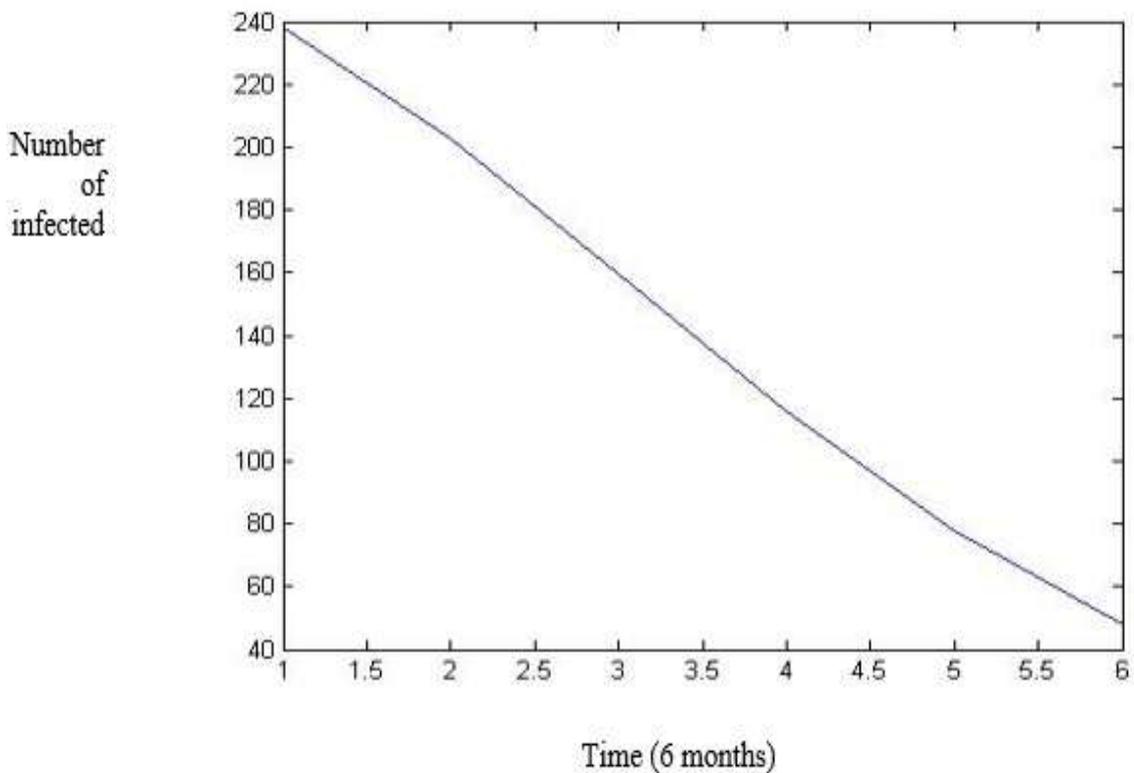


Figure (7) Monthly changes of the disease for positive samples

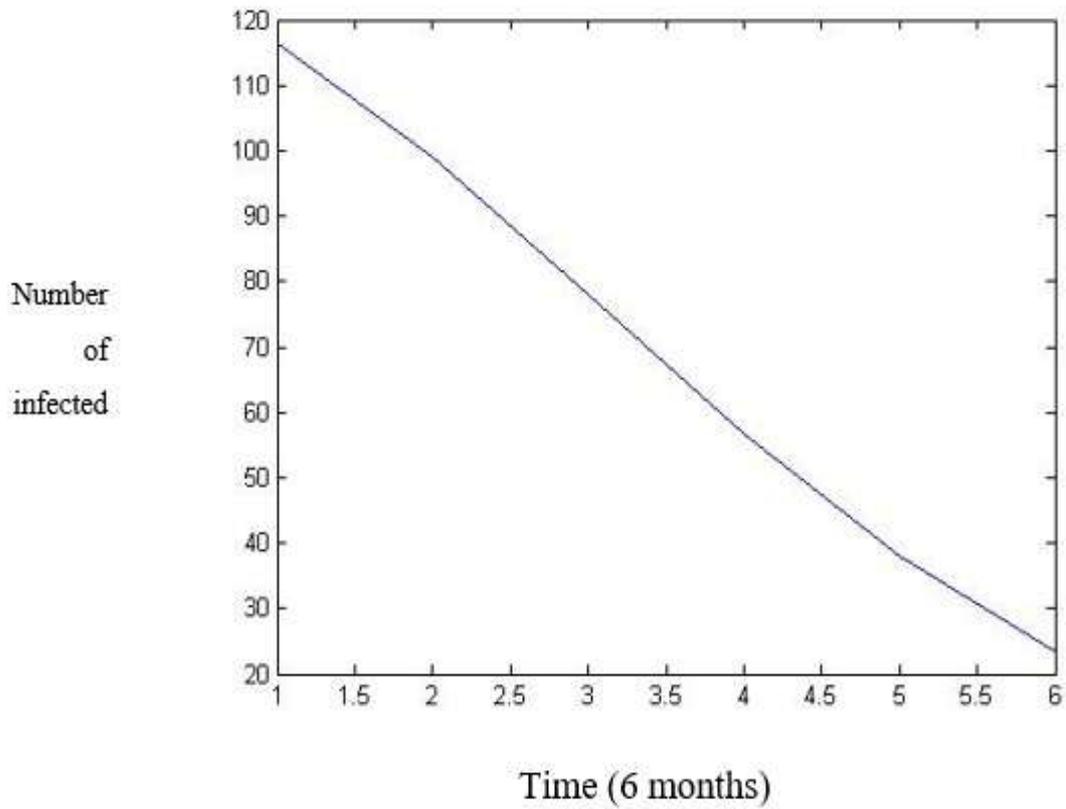


Figure (8) monthly changes of the disease for Illiteracy

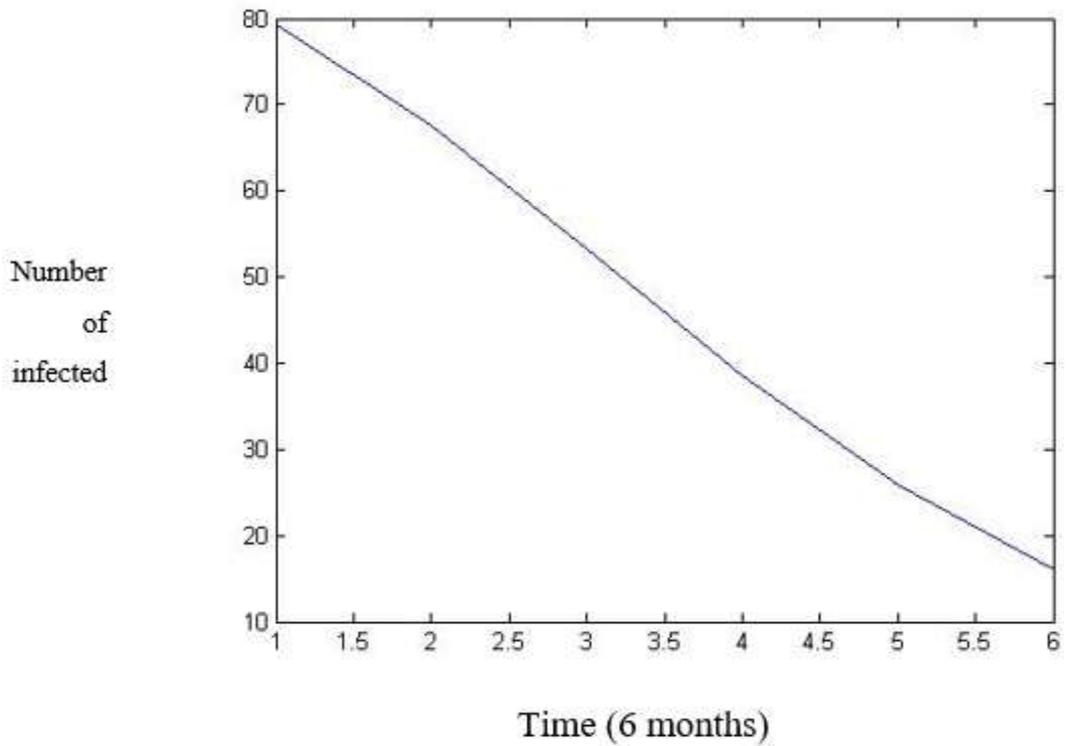


Figure (9) Monthly changes in the disease for individuals with primary education

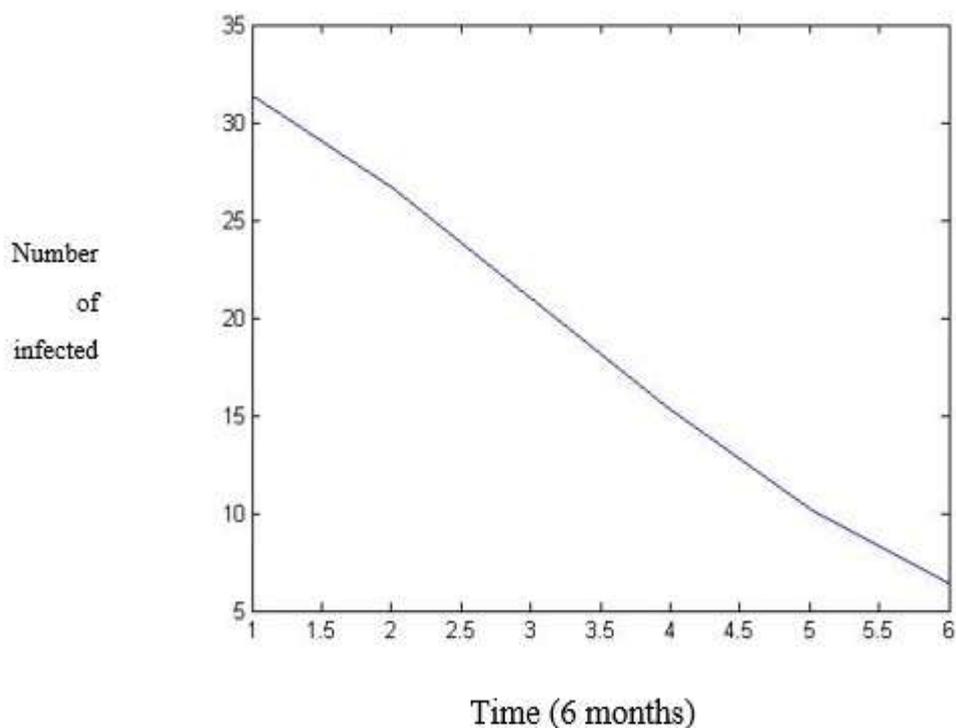


Figure (10) monthly changes in the disease for individuals with secondary education

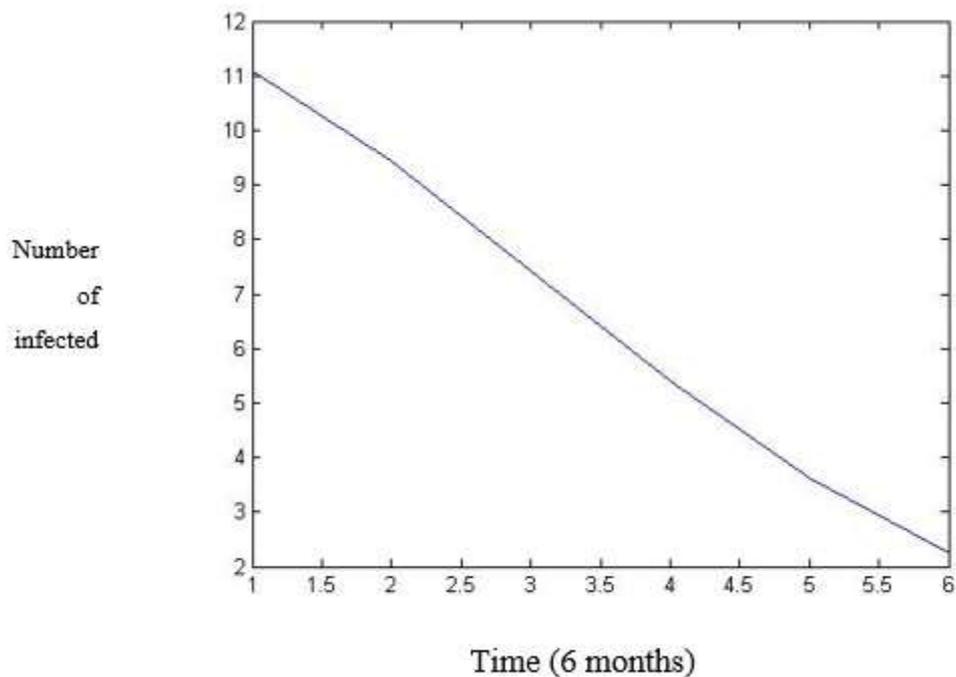


Figure (11) monthly changes in the disease for individuals with higher education

### V. DISCUSSION:

In the derivation of the gonorrhoea model, we used the derived simple epidemiological model [Gerda de V. et al, 2006]. To study the epidemiology of trichomonas vaginalis, we used the same mathematical model mentioned in the above source. It was found that the disease was spread through one infected individual who entered the healthy community, knowing that the infection spread from one person to another through contact. Those injured were recovered after a period of two weeks. In order to study the disease, we took the adopted

variable, which represents the number of infected individuals and its symbol with the symbol I. With the progression of time t, which represents the independent variable, we observe that the infected individuals are recovering. The number of samples examined was 857 samples over a period of 6 months (October 2009 - March 2010). Based on the data received, it was found that the rate of recovery was 50% during the recovery period, which lasted for two weeks, ie, approximately 64 individuals had recovered from 129 infected individuals and symbolized the possibility of recovery with the symbol p that:

$$p = \frac{64}{129}$$

The probability of recovery for each unit of time or what is known as the corresponding rate and symbolized by the symbol  $\alpha$ . Any that

$$\alpha = \frac{p}{\text{unit of time}} = \frac{0.5}{5} \cdot \frac{1}{\text{month}}$$

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