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Batik Motifs from SEIT Mathematical Modeling as a Representation of the Spread of Non-Genetic Diabetes

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Abstract: This study develops an interdisciplinary approach between mathematics, health, and batik art by utilizing the SEIT (Susceptible Exposed Infected Treatment) model as the basis for creating visual motifs. The SEIT model, which was previously used to model the spread of non-genetic diabetes, was reviewed and transformed into a geometric representation that can be visualized in the form of mathematical batik motifs. Each compartment in the model *Susceptible (S), Exposed (E), Infected (I),* and *Treatment (T)* is represented through interconnected pattern elements, reflecting the dynamics of population transition from a healthy state to the treatment stage. Mathematical analysis using a system of differential equations shows two conditions of stability, namely disease-free equilibrium and endemic equilibrium, with the basic reproduction number (R_0) as the main indicator. Based on the model parameters, a value of $R_0 = 0.09$ was obtained, indicating that the system is in a stable condition and disease spread tends to decline. These parameter values were then translated into symmetrical and repetitive patterns in batik motifs, symbolizing the balance between biological and social factors in the control of chronic diseases. The resulting batik motif features geometric elements in the form of a green circle (S) as a symbol of healthy life, a yellow half-moon (E) as the exposure phase, a brick-red triangle (I) as a warning sign of infection, and a blue lotus flower (T) symbolizing the process of treatment and recovery. These four shapes are connected by winding curved lines like a river flow, reflecting the continuous transition of the population in the SEIT system. Additional ornaments in the form of mathematical symbols such as $dS/dt, dE/dt, and\ |J|$ reinforce the scientific character of the design, while also serving as a reminder that batik patterns can also contain profound scientific concepts. Through the integration of mathematical modeling and batik art, this research not only provides innovation in understanding the dynamics of non-communicable diseases but also enriches Indonesia's cultural heritage by combining scientific value and visual aesthetics. The results are expected to serve as an educational and inspirational medium that demonstrates that mathematics is not limited to numbers and formulas but can also give rise to beauty, balance, and meaning in artistic expression.

Keywords: Batik, SEIT Model, Mathematical Modeling, Non-Genetic Diabetes, Pattern Visualization, Scientific Aesthetics.

Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease characterized by increased blood glucose levels due to disorders in insulin secretion or function. In general, there are two main types of diabetes, namely insulin-dependent diabetes mellitus (IDDM) and non-insulin-dependent diabetes mellitus (NIDDM). Type 2 diabetes is classified as a non-communicable disease that often develops as a result of unhealthy lifestyles, such as overeating, lack of physical activity, and environmental influences (American Diabetes Association, 2020). This condition causes insulin resistance, which is when the body cannot respond to insulin effectively, resulting in a significant increase in blood sugar levels. The World Health Organization (WHO) estimates that the number of type 2 diabetes sufferers in Indonesia will continue to increase in line with population growth and changes in people's lifestyles. If public awareness of the management of this disease does not increase, the number of diabetes sufferers is projected to reach 167 million by 2045. With the prevalence continuing to increase, efforts to prevent and control the spread of non-genetic diabetes are very important.

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Type 2 diabetes mellitus is a condition in which the body is unable to utilize insulin optimally, resulting in increased blood glucose levels. The main cause of this disease is insulin resistance, which is generally triggered by an unhealthy lifestyle. However, this disease can actually be prevented by adopting a healthy lifestyle, such as maintaining an ideal body weight, exercising regularly, and avoiding bad habits like smoking and drinking alcohol (Ardiani, H. E., Permatasari, T. A. E., & Sugiatmi, 2021). To understand the dynamics of disease spread, a mathematical model approach is used, one of which is the SEIT (Susceptible Exposed Infected Treatment) model. This model divides the population into four main compartments, namely individuals who are susceptible to disease (Susceptible), exposed but not yet infected (Exposed), infected (Infected), and undergoing treatment (Treatment). Each compartment describes the stages experienced by individuals in the population in relation to the process of disease spread and control. The SEIT model is formulated in the form of a system of differential equations that shows changes in the number of individuals in each compartment over time.

Several previous studies have utilized mathematical models such as SIR, SEIR, and SEIIT to describe the dynamics of disease spread, both infectious and non-infectious diseases such as diabetes. The SIR (Susceptible Infected Recovered) model describes three main phases in a population, while the SEIR (Susceptible Exposed Infected Recovered) model adds an Exposed compartment that represents individuals who have been exposed but have not yet shown symptoms (Wang et al., 2018). The SEIIT (Susceptible Exposed Infected Isolation Treatment) model was then developed to incorporate aspects of isolation and treatment (Wang, Li, & Zhang, 2020). In the context of non-genetic diabetes, this model describes individuals undergoing treatment as well as socioeconomic isolation factors that affect access to health services (Astutisari, 2021).

The study entitled "Batik Motifs from SEIT Mathematical Modeling as a Representation of the Spread of Non-Genetic Diabetes" developed the SEIT mathematical model as a form of visualization and artistic interpretation through batik motifs. Each compartment in the SEIT model (Susceptible, Exposed, Infected, and Treatment) is interpreted in motif elements and patterns that represent the dynamics of disease spread in the community. Thus, this approach is not only analytical but also symbolic and educational, showing how science and art can collaborate in communicating public health issues. The purpose of this study is to develop a SEIT mathematical model that describes the spread of non-genetic diabetes, while translating the model results into batik motifs as a visual representation of disease dynamics. In addition, this study also aims to calculate the basic reproduction number (R_0), analyze the stability of the equilibrium point, and review the sensitivity of parameters to disease spread. The results of this study are expected to contribute scientifically and culturally, enriching mathematical modeling studies in the field of health while expanding the meaning of batik as a medium of scientific expression. Through the combination of mathematics and batik art, it is hoped that the public will more easily understand the process of non-genetic diabetes spread and the importance of prevention through a healthy lifestyle.

Mathematical Model

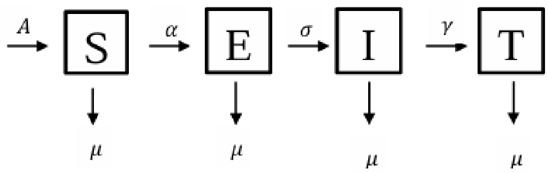
The SEIT model consists of four main compartments, namely Susceptible (S), Exposed (E), Infected (I), and Treatment (T). This model explains the process by which susceptible individuals can be exposed, then infected, and finally undergo treatment.

Assumptions used in the development of this model include

a. The total population is considered constant.
b. The modeled disease only includes type 2 diabetes without genetic factors.
c. Migration is ignored, so the spread of disease only occurs within a closed population.
d. People with type 2 diabetes cannot be completely cured, but they can receive treatment to prolong their lives.

e. Healthy individuals are placed in the Susceptible (S) compartment, while those who begin to experience a decline in insulin function are placed in the Exposed (E) compartment.
f. Individuals undergoing treatment are placed in the Treatment (T) compartment, and death can occur both during and outside of treatment.

The SEIT Mathematical Model for the Spread of Non-Genetic Diabetes based on the above assumptions is as follows:



The description of each compartment in the diagram above is as follows:

1. The susceptible compartment S increases due to the recruitment of new individuals at a rate of A , but decreases due to the movement of individuals to the exposed compartment E at a transition rate of α, as well as due to death at a rate of μ.
2. The exposed compartment E ncreases due to the movement of individuals from the compartment S a rate of α, but decreases due to transition to the compartment I a rate of σ and due to death at a rate of μ.
3. The infected compartment I increases from the compartment E at a rate of σ, but decreases as some individuals move to the (treatment) compartment T at a rate of γ and due to death at a rate of μ.
4. The treatment compartment T compartment increases due to migration from the compartment I at a rate γ, but decreases due to death at a rate μ.

It is known that in this model, the total population N population is considered constant, so the following relationship applies:

$$S + E + I + T = N$$

Based on the compartments described earlier, the process of non-genetic diabetes spread can be represented using the following system of differential equations:

$$\frac{dS}{dt} = A - (\alpha + \mu)S \quad ...(1)$$

$$\frac{dE}{dt} = \alpha S - (\sigma + \mu)E \quad ...(2)$$

$$\frac{dI}{dt} = \sigma E - (\gamma + \mu)I \quad ...(3)$$

$$\frac{dT}{dt} = \gamma I - \mu T \quad ...(4)$$

Equilibrium Point of the Mathematical Model of Non-Genetic Diabetes Spread

This section discusses the process of determining the equilibrium point of the SEIT model differential equation system used to describe the spread of non-genetic diabetes.

1. Ekulibrium Point

$$\frac{dS}{dt} = \frac{A}{\alpha + \mu}, \frac{dE}{dt} = 0, \frac{dI}{dt} = 0, \frac{dT}{dt} = 0$$

1.1 Disease-Free Equilibrium Point

The disease-free equilibrium point occurs when no individuals are exposed, infected, or undergoing treatment. This means that $E = 0, I = 0, T = 0$, so the analysis is focused only on the compartments , and the results are as follows:

From equation (1)

$$\frac{dS}{dt} = A - (\alpha + \mu)S$$

$$\frac{dS}{dt} = A - (\alpha + \mu)S = 0$$

$$A = (\alpha + \mu)S$$

$$S = \frac{A}{\alpha + \mu}$$

Therefore, the disease-free equilibrium point of the model is as follows:

$$EP_{0=}(S_0, E_0, I_0, T_0) = (\frac{A}{\alpha+\mu}, 0{,}0{,}0)$$

1.2 Endemic Equilibrium Point

The endemic equilibrium point describes the condition when the disease persists in the population, so that some individuals are exposed, infected, or undergoing treatment. At this point E, I, T the value of is positive, indicating that the disease has not completely disappeared from the system.

$$E \neq 0, I \neq 0, T \neq 0$$

a. From equation (1)

$$\frac{dS}{dt} = A - (\alpha+\mu)S$$

$$\frac{dS}{dt} = A - (\alpha+\mu)S = 0$$

$$A = (\alpha+\mu)S$$

$$S = \frac{A}{\alpha+\mu}$$

...(5)

b. From equation (2)

$$\frac{dE}{dt} = \alpha S - (\sigma+\mu)E$$

$$\frac{dE}{dt} = \alpha S - (\sigma+\mu)E = 0$$

Substitute equation (5) into equation (2)

$$\frac{dE}{dt} = \alpha(\frac{A}{\alpha+\mu}) - (\sigma+\mu)E = 0$$

$$\frac{\alpha A}{\alpha+\mu} = (\sigma+\mu)E$$

$$\frac{\alpha A}{(\alpha+\mu)(\sigma+\mu)} = E$$

c. From equation (3)

$$\frac{dI}{dt} = \sigma E - (\gamma+\mu)I$$

$$\frac{dI}{dt} = \sigma E - (\gamma+\mu)I = 0$$

Substitute equation (6) into equation (3)

$$\frac{dI}{dt} = \sigma\left(\frac{\alpha A}{(\alpha+\mu)((\sigma+\mu)}\right) - (\gamma+\mu)I = 0$$

$$\frac{\sigma\alpha A}{(\alpha+\mu)((\sigma+\mu)} = (\gamma+\mu)I$$

$$\frac{\sigma\alpha A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)} = I$$

...(7)

d. From equation (4)

$$\frac{dT}{dt} = \gamma I - \mu T$$

$$\frac{dT}{dt} = \gamma I - \mu T = 0$$

Substitute equation (7) into equation (4)

$$\frac{dT}{dt} = \gamma(\frac{\sigma\alpha A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)}) - \mu T$$

$$\frac{\gamma\sigma\alpha A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)} = \mu T$$

$$\frac{\gamma\sigma\alpha A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)\mu} = T$$

...(8)

This, the endemic equilibrium point of the disease is obtained as follows:

$$EP_{1=}(S_1, E_1, I_1, T_1) = (\frac{A}{\alpha+\mu}, \frac{\alpha A}{(\alpha+\mu)(\sigma+\mu)}, \frac{\sigma\alpha A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)}, \frac{\gamma\sigma\alpha A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)\mu})$$

2. Existence

The disease-free equilibrium point exists for all positive parameters: $(S_0, E_0, I_0, T_0) = (\frac{A}{\alpha+\mu}, 0{,}0{,}0)$.The endemic equilibrium point exists if and only if $R_0 = \frac{\alpha A}{(\alpha+\mu)(\sigma+\mu)} > 1$, with (S_1, E_1, I_1, T_1) as above.

...(6)

3. Stability

$$EP_{0=}(S_0, E_0, I_0, T_0) = (\frac{A}{\alpha+\mu}, 0{,}0{,}0)$$

$$f_1 = \frac{dS}{dt} = A - (\alpha+\mu)S$$

$$f_2 = \frac{dE}{dt} = \alpha S - (\sigma+\mu)E$$

$$f_3 = \frac{dI}{dt} = \sigma E - (\gamma+\mu)I$$

$$f_4 = \frac{dT}{dt} = \gamma I - \mu T$$

a. Derivatives f_1

$$\frac{df_1}{dS} = -(\alpha+\mu), \frac{df_1}{dE} = 0, \frac{df_1}{dI} = 0, \frac{df_1}{dT} = 0$$

b. Derivatives f_2

$$\frac{df_2}{dS} = \alpha, \frac{df_2}{dE} = -(\sigma+\mu), \frac{df_2}{dI} = 0, \frac{df_2}{dT} = 0$$

c. Derivatives f_3

$$\frac{df_3}{dS} = 0, \frac{df_3}{dE} = \sigma, \frac{df_3}{dI} = -(\gamma+\mu), \frac{df_3}{dT} = 0$$

d. Derivatives f_4

$$\frac{df_4}{dS} = 0, \frac{df_4}{dE} = 0, \frac{df_4}{dI} = \gamma, \frac{df_4}{dT} = -\mu$$

Jacobian Matrix $J(S,E,I,T)$:

$$\begin{bmatrix} \frac{df_1}{dS} & \frac{df_1}{dE} & \frac{df_1}{dI} & \frac{df_1}{dT} \\ \frac{df_2}{dS} & \frac{df_2}{dE} & \frac{df_2}{dI} & \frac{df_2}{dT} \\ \frac{df_3}{dS} & \frac{df_3}{dE} & \frac{df_3}{dI} & \frac{df_3}{dT} \\ \frac{df_4}{dS} & \frac{df_4}{dE} & \frac{df_4}{dI} & \frac{df_4}{dT} \end{bmatrix} = \begin{bmatrix} -(\alpha+\mu) & 0 & 0 & 0 \\ \alpha & -(\sigma+\mu) & 0 & 0 \\ 0 & \sigma & -(\gamma+\mu) & 0 \\ 0 & 0 & \gamma & -\mu \end{bmatrix}$$

Eigen Value $\lambda_i, i = 1,2,3,4$

Disease Free

$$\left| J\left(\frac{A}{\alpha+\mu}, 0,0,0\right) - \lambda I \right| = 0$$

$$\begin{vmatrix} -(\alpha+\mu)-\lambda & 0 & 0 & 0 \\ \alpha & -(\sigma+\mu)-\lambda & 0 & 0 \\ 0 & \sigma & -(\gamma+\mu)-\lambda & 0 \\ 0 & 0 & \gamma & -\mu-\lambda \end{vmatrix} = 0$$

$$\det \left(J\left(\frac{A}{\alpha+\mu}, 0,0,0\right) - \lambda I\right) = (-(\alpha+\mu)-\lambda)(-(\sigma+\mu)-\lambda)(-(\sigma+\mu)-\lambda)(-\mu-\lambda)$$

Then the eigen value is :

$$\lambda_1 = -(\alpha+\mu), \lambda_2 = -(\sigma+\mu), \lambda_3 = -(\gamma+\mu), \lambda_4 = -\mu$$

$$\lambda_1 < 0, \quad \lambda_2 < 0, \quad \lambda_3 < 0$$

4. Simulation

This section presents a numerical simulation of a mathematical model of non-genetic diabetes spread. Before the simulation is performed, a table of parameter sensitivity analysis results is first displayed, then the simulation is performed by entering the initial values of each compartment that have been systematically arranged in the following table:

Table 1. Sensitivity Analysis Parameter Values

Parameter	Value
α	1,1071
σ	29,9885
γ	-0.5187
μ	-0,441

Table 2. Initial Values of Variables.

No	Variabel	value
1	S	250
2	E	10
3	I	10
4	T	0

Using Mathlab, the initial graph for the spread of non-genetic diabetes was obtained, as follows:

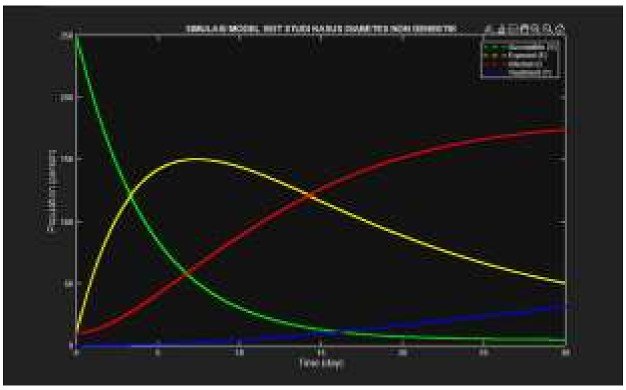


Figure 1. Initial Graph of Non-Genetic Diabetes Spread.

5. Interpretation

The figure shows that the susceptible population declines sharply due to the movement of individuals to the exposed compartment. The exposed population initially increases and then declines as individuals move to the infected compartment. The number of infected individuals increases after the exposed population peaks, indicating the progression of the disease. Meanwhile, the treated population remains low, indicating limited intervention or a slow treatment process.

BATIK

1. The Philosophical Meaning of Batik

This batik combines symbols of nature (leaves, moon, flowers) with scientific notation ($\partial, \frac{dS}{dt}, \frac{dE}{dt}, \sqrt{T}, |J|$), which symbolizes the harmony between nature, life, and science. Its philosophy can be described as follows:

a. Plant and vine patterns depict life that continues to grow and adapt, just like the human body and knowledge that continues to evolve.
b. Geometric shapes (triangles, circles, flowers) represent the balance of natural elements: earth, water, air, fire; as well as symbols of balance within the body and society.
c. Differential and integral symbols ($\frac{d}{dt}$, $\sqrt{T}, |J|$) depict change and the dynamics of time, such as changes in the body's condition (from healthy, exposed, sick, to treatment).
d. Natural colors (green, yellow, brick red) represent the balance between life (green), energy (yellow), and struggle (red), signifying that life and illness are natural cycles that can be understood and controlled through science.

Philosophically, this batik symbolizes the unity between science, nature, and human spirituality: illness is not a curse, but a natural process that can be studied and regulated.

2. Biological Meaning

In a biological context, each symbol in the batik can be linked to the biological processes of the spread and control of non-genetic diabetes:

a. Green leaves symbolize life and health, like body cells that are still "susceptible" (compartment S = Susceptible).
b. The moon with waves depicts the body's metabolic phases, the rise and fall of blood sugar levels as a natural cycle.
c. The red triangle represents physiological changes leading to exposure (E = Exposed), when diet and lifestyle begin to affect insulin resistance.
d. The blue flower represents the treatment phase (Treatment, T), symbolizing recovery through therapy and lifestyle changes.
e. The red lightning bolt represents unbalanced bodily energy activity (I = Infected), signifying a condition where insulin cannot function effectively.

Thus, biologically, this batik is a visualization of the cycle of cellular life and bodily metabolism, from healthy, exposed, sick, to treatment, aligned with the dynamics of SEIT in the article.

3. The Mathematical Meaning of Scientific Batik

The batik contains mathematical symbols directly related to the SEIT mathematical model, namely the Susceptible–Exposed–Infected–Treatment model. Each symbol reflects the components of differential equations, stability analysis, and dynamic parameters in the SEIT system used to model the spread of non-genetic diabetes.

1. Symbol $\frac{dS}{dt}$ $dan \frac{dE}{dt}$
   a) Mathematical Meaning:
   Represents the derivative with respect to time (t), which is the rate of change in the number of individuals in the Susceptible (S) and Exposed (E) compartments. Formally, based on the article:

   $$\frac{dS}{dt} = A - (\alpha + \mu)S$$
   $$\frac{dE}{dt} = \alpha S - (\sigma + \mu)E$$

   This describes how the number of healthy people (S) decreases over time due to exposure to the disease (αS), and how exposed individuals (E) increase before moving to the infection stage (σE).
   b) Meaning in Batik:
   This symbol is placed among circular plant ornaments, signifying continuous change, the core concept of differential calculus.
2. Symbol $\frac{dE}{dt}$ $dan \frac{d}{dt}$
   a) Mathematical Meaning:
   The general derivative $\frac{d}{dt}$ represents the change in a function over time. In the SEIT model, each compartment (S, E, I, T) has a derivative over time that forms a system of first–order differential equations:

   $$\left\{\begin{array}{c} \dfrac{dS}{dt} = A - (\alpha + \mu)S \\ \dfrac{dE}{dt} = \alpha S - (\sigma + \mu)E \\ \dfrac{dI}{dt} = \sigma E - (\gamma + \mu)I \\ \dfrac{dT}{dt} = \gamma I - \mu T \end{array}\right\}$$

   Ini This is called a continuous dynamic system model, which describes how the number of individuals in each compartment changes over time.
   b) Meaning in Batik:
   This symbol is depicted at the top with a curved pattern that merges together, illustrating that all variables change simultaneously within a single dynamic system.
3. Symbol $|J|$
   a) Mathematical Meaning:
   Menyatakan It represents the determinant of the Jacobian matrix (J). In the stability analysis of differential systems, the Jacobian matrix is used to determine whether an equilibrium point is stable or not. The Jacobian matrix of the SEIT model is:

   $$J = \begin{bmatrix} -(\alpha + \mu) & 0 & 0 & 0 \\ \alpha & -(\sigma + \mu) & 0 & 0 \\ 0 & \sigma & -(\gamma + \mu) & 0 \\ 0 & 0 & \gamma & -\mu \end{bmatrix}$$

   The determinant value or eigenvalue (λ) of J determines whether the system will return to equilibrium or become unstable:

   $$\lambda_1 = -(\alpha + \mu), \lambda_2 = -(\sigma + \mu), \lambda_3 = -(\gamma + \mu), \lambda_4 = -\mu$$

   Since all λ are negative, the system is asymptotically stable (does not grow infinitely).
   Meaning in Batik:
   The symbol $|J|$ placed near the roots and leaves symbolizes the balance and stability of the system, such as the stability of biological ecosystems.
4. Symbol $\sqrt{T}$
   a) Mathematical Meaning:
   Represents the Treatment (T) compartment in the SEIT model. $\sqrt{T}$ can be interpreted as a non-linear transformation that symbolizes the effect of treatment or care that slows down the rate of change in the system. In the context of the system, the rate of change of T is given by:

   $$\frac{dT}{dt} = \gamma I - \mu T$$

   Here γI indicates the rate at which individuals enter treatment, dan μT indicates natural morality

b) Meaning in Batik
Akar kuadrat (√) menggambarkan "pemulihan parsial" bukan kesembuhan total, tetapi stabilisasi kondisi tubuh (sejalan dengan kenyataan bahwa penderita diabetes tipe 2 tidak sembuh total, tetapi bisa dikontrol).

5. Overall Mathematical Meaning

This batik is a geometric visualization of a system of nonlinear differential equations:

$$\frac{dX}{dt} = f(X)$$

with $X = [S, E, I, T]^T$

Where each symbol and color represents a compartment and the dynamic interactions between variables. The plant patterns and swirling flows indicate the continuity of the system (continuous-time system) and the asymptotic stability described in the article through Jacobian analysis.

Conclusion

Based on the results of the analysis and visual interpretation of the SEIT model on the spread of non-genetic diabetes, the following conclusions were obtained:

1. The SEIT (Susceptible Exposed Infected Treatment) mathematical model describes the dynamics of the spread of non-genetic diabetes through four population compartments, namely susceptible (S), exposed (E), infected (I), and treated (T) individuals. Analysis of the differential equation system shows two equilibrium points, namely:
   a. Disease-free equilibrium point $P_0 = (S, E, I, T) = (\frac{A}{\alpha+\mu}, 0,0,0)$, which indicates a population without infection
   b. The endemic equilibrium point $P_1 = (S^*, E^*, I^*, T^*)$, which represents a condition where the disease persists in the population with positive values in each compartment..
2. The basic reproduction number (R_0) obtained from the model calculation is:

$$R_0 = \frac{\alpha\sigma A}{(\alpha+\mu)(\sigma+\mu)(\gamma+\mu)}$$

3. Based on the parameters used in the simulation, the value obtained is . This value indicates that the system is in an asymptotically stable state, where the rate of disease spread decreases over time until it eventually reaches a disease-free population stability.
4. Local stability analysis shows that the P_0 stable if $R_0 \leq 1$, and the point P_1 becomes locally stable if $R_0 > 1$. Since the calculation results show $R_0 < 1$, the population tends towards a disease-free condition, and the spread of non-genetic diabetes can be well controlled

Numerical simulation results show that the number of individuals in the susceptible compartment (S) initially decreases due to disease exposure, then increases again as the number of individuals in the infected compartment (I) decreases. Meanwhile, the treatment compartment (T) tends to be stable in the long term, indicating the effectiveness of interventions in disease control.

Artistic interpretation in the form of batik motifs produces visual patterns that represent the dynamics of the SEIT system. The S, E, I, and T compartments are visualized as different geometric shapes and colors: a green circle (S) symbolizes healthy life, a yellow half-moon (E) symbolizes the exposure phase, a brick-red triangle (I) symbolizes infection, and a blue lotus flower (T) symbolizes treatment and recovery. The curved lines connecting the elements symbolize the continuity of the dynamic system and population stability as indicated by the value of R_0.

Through the integration of mathematical modeling and batik art, this study proves that scientific concepts in differential systems can be realized in visual forms that are rich in cultural meaning. Thus, batik motifs not only function as aesthetic expressions, but also as educational media that demonstrate the balance between science, art, and human values in understanding and controlling chronic diseases such as non-genetic diabetes.

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