

STABILITY ANALYSIS OF MATHEMATICAL MODEL ON THE EFFECT OF MODERN LIFESTYLES TOWARDS THE IMMUNE SYSTEM

(Analisis Kestabilan Model Matematik bagi Kesan Cara Hidup Moden Terhadap Sistem Imun)

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ABSTRACT

During the last century, lifestyles have changed globally not only in the western countries but also in the developing countries. As a result, the percentages of common fatal diseases, such as obesity, diabetes, cardiovascular disease, and cancer, have dramatically increased, especially in youth. This paper aims to mathematically examine the impact of modern lifestyle on health. Furthermore, we formulate a dynamical model for the impact of a balanced diet, regular exercise and sufficient sleep on the immune system and its processes. We present a stability model of the immune system that includes a cycle of phase-specific vitamins. Ordinary differential equations are used to model the system to describe the functioning of immune cells. The model considers three populations: normal cells, immune cells, and vitamin interventions. The results show that a balanced diet and a healthy lifestyle can boost the immune system and improve its processes to protect a human body from pathogens. In conclusion, a balanced diet and physical activity reduce the percentage of fatal disease risk. Furthermore, it is vital to raise awareness about healthy habits and promote healthy eating, especially for the youth.

Keywords: malnutrition; supplement dietary; bout exercises; malfunction in immune system; unhealthy body

ABSTRAK

Semenjak abad lalu, gaya hidup telah berubah secara global bukan sahaja di negara barat tetapi juga di negara sedang membangun. Akibatnya, peratusan penghidap penyakit maut yang lazim, seperti obesiti, diabetes, penyakit kardiovaskular dan kanser, telah meningkat secara dramatik, terutamanya dalam kalangan belia. Kajian ini dijalankan dengan tujuan untuk mengkaji secara matematik kesan gaya hidup moden terhadap kesihatan. Selain itu, rumus model dinamik untuk kesan diet seimbang, senaman yang kerap dan tidur yang mencukupi pada sistem imun dan prosesnya dibincangkan. Satu model kestabilan sistem imun yang merangkumi kitaran vitamin fasa khusus dibentuk. Persamaan pembezaan biasa digunakan untuk memodelkan sistem untuk menggambarkan fungsi sel imun. Model ini mempertimbangkan tiga populasi: sel normal, sel imun, dan penggunaan vitamin. Hasilnya menunjukkan bahawa diet seimbang dan gaya hidup yang sihat dapat meningkatkan sistem imun dan memperbaiki prosesnya untuk melindungi tubuh manusia dari patogen. Sebagai kesimpulan, diet yang seimbang dan aktiviti fizikal dapat mengurangkan peratusan risiko penyakit maut. Tambahan pula, adalah penting untuk meningkatkan kesedaran mengenai tabiat yang sihat dan menggalakkan pemakanan yang sihat, terutamanya dalam kalangan belia.

Kata kunci: malnutrisi; makanan tambahan; senario senaman; malfungsi dalam sistem imun; badan tidak sihat

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