Web based food combination system for diabetes mellitus type 2 with genetic algorithm

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Abstract. As the age of a person makes it easily infected with a disease such as diabetes. In this case, the food of people suffering from the disease must eat foods that are in accordance with the nutrients needed to reduce the patient's blood sugar levels. Based on this problem, this study aims to develop a food combination system to help diabetics manage food according to patient criteria. This system requires criteria for producing food combinations and using genetic algorithm methods to produce the best alternative food combinations for diabetics. The combination of food resulted is taken based on the efficiency of chromosomes from genetic algorithms. The genetic algorithm accuracy calculation method reaches 100% by comparison with manual calculations from 5 test cases that have been made. From these results it can be concluded that the application of genetic algorithm methods is sufficient to assist diabetics in making food combinations that fit the patient's criteria.

Keywords : Algorithm Genetic, Diabetes, Food Combination

1. Introduction
This website application is developed to help someone suffering from diabetes to regulating food that corresponds to the nutrition and calories needed. Nutrition and calories a person needs varies with different body weight, height, and age as well. Food combination settings for diabetics are based on criteria of calorie requirement obtained with personal data. The combined foods consist of carbohydrate sources, vegetable protein sources, animal protein sources, and vegetables. In order to help diabetics in regulating food combinations this website applications is hoped will help to assist in the manufacture of food combinations.

2. Method and materials
2.1 System development method
To develop this application, Method of genetic algorithm is used as food combinations maker. Genetic algorithm is computational algorithms inspired by later evolutionary theories adopted into a computational algorithm to find a solution to a problem in a more “natural”[1]. A The algorithm genetic method is chosen as the basis of the program because the algorithm genetic has a simple methodologi with many relative that develop each iteration. Algorithm genetic work with a variety of populations not just a single point with probabilistic displacement rules rather than deterministic[2]. The workings of the genetic algorithm method are by first determining 2 parent chromosomes with random gene contents, then doing crossovers and mutations. After doing the crossover and mutation process, the algorithm method will calculate the fitness of each chromosome[3]. Chromosomes that reach a minimum limit of fitness value that has been determined, the chromosome will be selected to be the best chromosome.

2.2 Materials
The data materials that being used in this program are food name data consisting of nutrition and calories. The food data is derived from the results of data collection and publication by KEMENKES Indonesia which lays out nutrition and calorie data in the food.
3. Results and discussion

3.1 Calorie needs

This website application requires a person's calories as a limitation for the course of genetic algorithm methods. The app asks to include personal data such as height, gender, age, weight, and types of activities because a person's calorie needs are all different, so data is needed[4]. These data are needed to calculate a person's calorie needs[5]. Based on the calorie requirement that has been obtained, the genetic algorithm will do the calculation to obtain a combination of food that fits the needs of the calorie that has been calculated. The input Form required to fill in the Account registration page (Figure 1).

![Figure 1. Registering an account.](image)

3.2 Food list

In this website application list of food that have been inserted will be displayed with the page itself. List of food in the website application provides nutritional content of food and calorie food (Figure 2).

![Figure 2. List of food.](image)
3.3 Display Calculation BMI
In this website application on the main page users can do BMI calculations by entering weight, height, and age (Figure 3).

![Display Calculation BMI](image)

**A. Input form for calculation BMI**
**B. Calculation BMI Result**

3.4 Display Food Combination
Users who have logged into the website and checked the box in the BMI calculation and pressing the Calculate button can see the results of the combination of food that has been made. On the Food combination page will be shown a box of 30 with the date corresponding to today. In the box the combination of food has been created with the criteria that have been inserted (Figure 4).
4. Conclusion and Future Works

This website application provides information about food with various nutritional and calorie content. Because information displayed by users can learn about the content in a meal that has been provided. With the application of this website hope to help diabetics in regulating their food in accordance with the nutrients and calories needed. The genetic algorithm method used in this website application works very well with an accuracy rate of 100% with a comparison of manual calculations and calculations of the program. The schedule is also in accordance with the comparison.
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