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Machine Learning Application for Diet Maintenance Period

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Abstract

Objective: This study addresses one of the challenges faced during the post-diet maintenance phase: tracking nutrient intake. It aims to facilitate weight management for individuals in this period.
Materials and Methods: First, a consultation with a registered dietitian was conducted to understand the process, and sample maintenance phase meal plans were obtained. Based on this, a Windows Forms application was developed to enable individuals to track their food intake during their maintenance phase. The application helps users maintain a healthy and balanced diet during the post-diet maintenance period by considering their dietary preferences and needs and simplifying nutrient tracking. The application interface includes a user registration screen and an exchange calculation screen. Based on the data obtained from the user registration screen, the total exchange amounts can be viewed on the exchange calculation screen. By entering their daily food intake, users can see their remaining exchange rights, ensuring effective tracking during the maintenance phase.
Findings: A regression model was developed using the data collected from the application to determine whether there is a relationship between eating habits and weight. The findings indicate significant relationships between the consumption of certain nutrients and weight.
Conclusion: Based on these relationships, a valid regression model was created that can be used for future weight predictions. Additionally, the developed application allows users to track their nutrient intake during the post-diet maintenance phase, enabling them to maintain a healthy and balanced diet.

Keywords: C#, diet, maintenance period, machine learning, python

1. Introduction

Adequate and balanced nutrition is necessary to maintain a healthy life. Weight control is one of the biggest problems of our age; overweight is harmful and underweight can lead to health problems [1]. To avoid these health risks, people follow various diet programs and try to reach their goals. However, maintaining weight after weight loss is also a great challenge. In this process, nutrient monitoring is critical for individuals to lead a healthy life.

This problem encountered during the weight maintenance period is widely observed in the fields of nutrition and dietetics, health and sports. Weight control and maintenance are vital for the prevention of obesity and other health problems. Our motivation in this study is to help individuals in the weight maintenance period to lead a healthy life by providing more effective nutrient monitoring and management.

In this study, a Windows form application was developed to facilitate nutrient tracking during the post-diet maintenance period. First, the information and data sets needed in this field were obtained by interviewing an expert dietitian. This data formed the basis of the application and a Windows form application was developed using C# language. Thanks to the application, users will be able to enter the foods they eat during the day into the system to track whether they comply with the protection period program they receive under the follow-up of the dietician, and they will be able to get information about how much more they should eat from which food groups for that day.

Regression analysis was among the methods used in our study. This method was used to determine the relationship between dietary habits and weight. In particular, the effect of meat, milk, fat, bread, fruit and vegetable consumption on weight was examined and a regression model was created accordingly. The accuracy of the model was assessed by low mean square error (MSE) and high R^2 score on the test data.

In this study, the application developed for individuals in the weight maintenance period aims to help them maintain a healthy life by facilitating nutrient tracking. With the data obtained from the application, the link between dietary habits and weight was analyzed and a valid regression model was created for future weight predictions.

In the methodology section, a summary of the literature on diet, weight control, nutrient tracking, C# programming machine learning and regression modeling is presented. The problem of nutrient tracking in the post-diet maintenance period is defined and the C# application interface developed for this problem is presented. The design and development processes of the Windows form application we developed using C# programming language are explained in detail, and the process of collecting and analyzing user data is detailed. All findings are summarized and the contribution of the application to the users' healthy life is evaluated.

2. MATERIALS AND METHODS

2.1. Literature Summary

Tokgöz, Ertem, Çelik, Gökçe, Saka and Hatunoğlu investigated the eating habits of Dicle University students and investigated what percentage of them ate healthy and without skipping meals and what percentage of them ate unhealthy and skipped meals. He divided the students into groups by looking at their body mass index and examined the reasons for the difference between eating habits. They found that the main reasons for skipping meals were educational status, economic structure, income and expenditures and cultural structure. They made suggestions to improve this problem [2].

In his study, Erge, S. stated that only diet and exercise would not be sufficient in the treatment of obesity. He mentioned that in the treatment of obesity, it is essential to create a nutrition program suitable for the individual's personal characteristics, abilities and lifestyle, to balance energy intake and expenditure, and that this program should be designed in a way that the individual can feel happy and comfortable and should be supported by exercise and behavior change methods. He argued that only in this way can obese individuals achieve the desired weight loss and maintain their current healthy weight and be protected from the health problems caused by obesity [3].

In her study, Bozkurt focused on a web-based nutrition education and personal nutrition management tool designed to address nutrition problems in Turkey. This tool aims to positively change individuals' dietary habits by increasing nutritional knowledge and support personal nutrition management. The study used C#, an object-oriented programming language developed on the .NET platform. It was also stated that the study contributed to studies on personal health records by increasing knowledge and awareness on personal health management [4].

In this study, Dilmen and Ertam described the development of a computer program called Nutrition and Health Tracking (NHT), which uses Body Mass Index (BMI) to diagnose and monitor nutritional disorders in high school students. BST aims to identify and address weight and height problems in young people through early detection and interventions. BST identifies nutritional disorders through BMI calculations. The program provides diet and exercise recommendations according to BMI categories and intervenes by monitoring the student's progress. Researchers have noted that BMI does not take into account factors such as bone density and may be inaccurate in young people. Regional and cultural differences may also affect BMI interpretations [5].

In their research paper, Saylı and Akbulut discussed the development of a dietary control system to improve communication between dietitians, users and administrators. They stated that this system was

developed using SQL-based C#. They aimed to provide users with easy access to measurement and diet information and to provide access to the information they want from anywhere. They also stated that the system aims to save time and money for dieters. In general, they emphasized the importance of improving the diet management process and diet control system [6].

In their study, Dandıl and Bilen focus on the importance of work follow-up and management in universities. Their study is based on the fact that all departments can increase time efficiency in defining, monitoring and solving business processes by using a common database. Their work was carried out on Windows Azure infrastructure using C# and Asp.net programming languages. The research results emphasize the importance of using cloud computing technology for work tracking in universities to increase productivity. This study deals with a cloud computing application that can contribute to a more organized structure of work tracking processes in universities and increase productivity [7].

An important part of Aktaş and Akçay's dissertation includes an automation system software that any hospital service may need and that can meet the needs of the hospital. However, considering that the requirements may vary from hospital to hospital in SAP project studies, they developed a software product for general common requirements in this project. Visual Studio, which is used as the compiler for the C# programming language, has been examined and detailed explanations have been provided for first-time users to familiarize them with the interface components. In particular, they stated that C# is widely used in applications developed using Microsoft Visual Studio [8].

In their study, Şen, Yaşayanlar and Denizhan analyzed cargo transportation data from Turkey's sea ports. They performed data analysis on cargo statistics for the last 15 years obtained from the Ministry of Transportation and Infrastructure of the Republic of Turkey. In this analysis, they applied linear regression and artificial neural network methods using WEKA software and Python programming language and compared the results. When the accuracy rates of the forecasts were compared, they observed that the artificial neural network method gave more accurate results. The study is the first application for freight transportation data in ports and reveals that countries can increase their competitive advantage with the correct use of these data [9].

In their study, Rong and Bao-Wen used a regression model in machine learning to analyze the effect of temperature change on the sales of iced products. They built a simple linear regression model using Python programming language, taking temperature forecasts as the independent variable and sales of iced products as the dependent variable. First, they collected the previous year's temperature forecast data and the sales data of iced products, and then performed data compilation and cleaning on these data. Based on the cleaned data, they built a linear regression model to examine the relationship between independent and dependent variables. By applying the model, they were able to predict product sales based on temperature changes and with these predictions, they helped companies to adjust their production plans more flexibly. The study offers significant commercial value in determining the right production and sales strategies and provides an important theoretical basis for other companies producing iced products [10].

Yüce and Muz [12] investigated the effects of the pandemic on the dietary behavior of individuals through a questionnaire survey. They interpreted that the results were significant.

2.2. Application Interface (C# Application)

The developed C# Windows form application is a tool that will enable users to track their compliance with the nutrition plan they have determined with their dietician. The application interface is designed in such a way that the user can easily enter data and monitor daily nutrient intake. The main components of the interface are as follows:

Home screen: a landing page for users. It is given in Figure 1.

Figure 1. Landing page for users.

Sign up screen: Allows users to log in to the application. Obtains name, surname, height and weight information from the user. It stores this information in a database and stores the person's information. The height and weight information will be used for Body Mass Index (BMI) calculation. Height information should be written in cm. It is given in Figure 2.

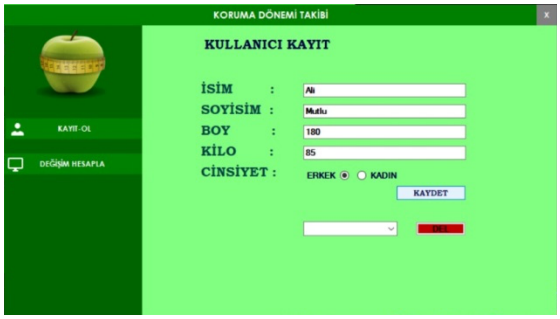

Figure 2. Sign up screen

Change calculation screen: The screen where users can enter and track their daily food consumption. On this screen, the person's information is taken and BMI is calculated. It is located between the meals and the change table. If this number is below 22, the first change table is printed, if it is above 22, the recommended daily nutrient change numbers for the person are printed using the nutrient change numbers obtained from the second change table. For each meal, there are drop-down boxes to select portions and foods. After the person has made his/her selection, he/she should add. It is given in Figure 3.

Figure 3. Application form

There is a table below the meals that gives information about the remaining change. The total change row shows the number of changes for each food group recommended for the person. The selected exchange row gives the exchange value of the nutrients when the person adds food. The remaining change row is the number of remaining nutrient changes that the person can take for that day. This information is saved in the database.

Nutrient Database: A database where users can select the information received in the registration section and the foods they eat. This database contains foods from different food groups and their nutrient exchange values. The first 100 IDs in the nutrient values are assigned to breakfast, 100-200 to lunch, 200-300 to dinner, and after 300 to snacks.

2.3. Linear Regression Analysis

Linear regression is a statistical technique used to model the relationship between a dependent variable (y) and one or more independent variables (x). It was first defined by Francis Galton in the 19th century and later expanded [11]. The main purpose of linear regression is to find a linear equation that best represents the relationship between data.

The parameters, decision variables and mathematical model of the linear regression model are as follows:

- Parameters:

$$\beta 0: Intercept$$

$$\beta 1, \beta 2, \ldots, \beta n: Coefficients\ of\ independent\ variables$$

$$\epsilon: Error\ term\ (residual\ error)$$

- Decision Variables:

$$y: Dependent\ variable\ -\ the\ value\ to\ be\ estimated$$

$x1, x2, \ldots, xn$: Independent variables - inputs used for estimation

- Mathematical Model:

$$y = \beta 0 + \beta 1x1 + \beta 2x2 + \ldots + \beta nxn + \epsilon y\ =\ \beta 0 + \beta 1x1 + \beta 2x2 + \ldots + \beta nxn + \epsilon$$

The purpose of a linear regression model is to measure the effect of independent variables on the dependent variable. This model is widely used in different fields and can be applied to many real-world problems.

2.4. Application Problem

The study was developed in Python programming language using Jupyter Notebook IDE on Anaconda platform. Linear regression model is a statistical method used to mathematically model the relationship between dietary habits and weight and to evaluate the strength of this relationship. In this study, the effect of meat, milk, fat, bread, fruit and vegetable consumption on weight was examined and a regression model was created accordingly. The independent variables consist of the given nutrients (meat, milk, fat, bread, fruit and vegetables). The dependent variable is the user's weight. In the current system, post-diet weight maintenance tracking is done manually, which leads to difficulties in tracking. Inconsistencies and missing data in weight tracking reduce the effectiveness of the diet program and negatively affect users' motivation. Regression analysis will allow for more accurate tracking and predictions by modeling the relationship between dietary habits (meat, milk, fat, bread, fruit and vegetable consumption) and weight.

Different Directions and Constraints:

Different Aspects: The regression model can be personalized to individual dietary habits and can be applied individually for each individual's specific diet program.

Limitations: The accuracy of the model depends on the quality of the data used and external factors not considered in the model. It may also be limited to short-term data.

Acceptances:

Assumptions: It is assumed that individuals' dietary habits and metabolic rates will remain constant during the period the model is valid.

Data Collected:

Data Types (Parameters):

- Meat consumption
- Milk consumption
- Fat consumption
- Bread consumption
- Fruit consumption
- Vegetable consumption
- Daily weight measurements

Added Constraints:

Constraints:

- The data needs to be free of missing or erroneous data that could affect its accuracy.
- The model is only valid for a specific time period and should be recalibrated for longer-term forecasts.

Multiple Linear Regression Analysis

Linear regression analysis was used to model the effect of independent variables on the dependent variable. In this analysis, meat, milk, fat, bread, fruit and vegetable consumption were used as independent variables and total calories were set as the dependent variable.

The regression model is expressed in the following mathematical form:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \epsilon$$

Here the is:

$Y: User's\ weight$

$X1: Meat\ consumption\ (change)$

$X2: Milk\ consumption\ (change)$

$X3: Oil\ consumption\ (change)$

$X4: Bread\ consumption\ (change)$

$X5: Fruit\ consumption\ (change)$

$X6: Vegetable\ consumption\ (change)$

$\beta 0: Constant\ term$

$\beta 1, \beta 2, \beta 3, \beta 4, \beta 5, \beta 6: Coefficients\ of\ independent\ variables$

$\epsilon: Error\ term$

This model is used to estimate the effect of consumption of specific food groups on weight.

Data Collection

Data Required for C# Windows Form Application

The contents of the product groups between table 1 and table 6 are given. They are vegetable, fruit, bread, oil, meat and milk group contents respectively. The data in Table 1 - Table 6 were obtained in consultation with the expert dietician.

Table 1. Vegetable Group

Vegetable	Average Measure	Amount (g)
Okra	4 tablespoons (cooked)	75 g
Charleston Pepper	4 medium size	100 g
Tomato	1 small size	100 g
Tomato Juice	1 tea glass	100 g
Mallow	4 tablespoons (cooked)	150 g
Spinach	4 tablespoons (cooked)	150 g
Cauliflower	4 tablespoons (cooked)	100 g
Red Cabbage	1/8 medium size	100 g
Red Radish	5 small size or 1 medium size	100 g
Lettuce	10 leaves	100 g
Dry Onion	1 medium size	75 g
Cabbage	4 tablespoons (cooked)	100 g
Mushroom	2 tablespoons (cooked)	100 g
Lettuce	5-6 leaves	100 g
Parsley	1 medium bunch	100 g
Eggplant	4 tablespoons (cooked)	125 g
Chard	4 tablespoons (cooked)	150 g
Arugula	1 medium bunch	100 g
Cucumber	2 medium size	100 g
Purslane	4 tablespoons (cooked)	150 g
Green Beans	4 tablespoons (cooked)	150 g
Fresh Zucchini	4 tablespoons (cooked)	150 g
Watercress	1 medium bunch	100 g
Green Bell Pepper	2 medium size	100 g
Green Chili Pepper	10 medium size	100 g
Green Onion	3-4 medium size	75 g

Table 2. Fruit Group

Fruit	Average Measure	Amount (g)
Raspberry	1/2 cup of water	75 g
Pineapple	1 thin slice	75 g
Pear	1 medium size	100 g
Quince	1/4 medium size	80 fr
Blackberry	1/2 su bardağı	75 g
Strawberry	12 pieces	175 g
Lemon	1 medium size	100 g
Apple	1 little size	100 g
Plum	5 pieces	100 g
Grapefruit	1/2 medium size	125 g

Tangerine	1 large size	100 g
Green Plum	10 pieces	50 g
Loquat	6 pieces	125 g
Apricot	3 pieces	100 g
Red Plum	5 pieces	50 g
Cherry	12 pieces	75 g
Kiwi	1 medium size	120 g
Damson Plum	3-4 pieces	125 g
Pomegranate	1/2 little size	80 g
Orange	1 medium size	100 g
Peach	1 medium size	100 g
Bitter Orange	1 medium size	100 g
Cherry	14 pieces	80 g
Watermelon	1 thin slice	200 g
Melon	1 thin slice	200 g
Mulberry	8 pieces	50 g
Baghdad Date	1/2 medium size	50 g

Table 3. Bread Group

Bread	**Average Measure**	**Amount (g)**
Bread	1 thin slice	25 g
Lentil Soup	1 bowl	20 g
Tarhana Soup	1 bowl	20 g
Wheat Flour Soup	1 bowl	20 g
Tomato Soup	1 bowl	20 g
Rice Soup	1 bowl	15 g
Ezogelin Soup	1 bowl	15 g
Rice Pilaf	3 Tablespoons	20 g
Bulgur Pilaf	3 Tablespoons	20 g
Couscous	3 Tablespoons	20 g
Pasta	3 Tablespoons	20 g
Noodles	3 Tablespoons	20 g
Potato	1 little size	90 g
Chestnut	2 medium size	30 g
Popcorn	1 cup of water	20 g
White Chickpeas	1 tea glass	50 g
Yellow Chickpeas	1 tea glass	50 g
Etimek	2 slice	18 g
Grisin	3 pieces	20 g
Thin Cracker	13-18 pieces	18 g
Cracker	5 pieces	22 g
Breadcrumbs	2 pieces	19 g
The breadcrumbs are plain, large.	1 piece	20 g
breadcrumbs, plain, small	7 pieces	20 g

Goldenrod with bran	4,5 pieces	20 g
Sesame Stick Kıraker	4 pieces	20 g

Table 4. Oil Group

Oil	Average Measure	Amount (g)
Sunflower Oil	1 dessert spoon	5 g
Walnut	1-2 pieces	8 g
Hazelnut	5-6 pieces	10 g
Hazelnut Oil	1 dessert spoon	5 g
Corn Kernel Oil	1 dessert spoon	5 g
Soybean Oil	1 dessert spoon	5 g
Olive	5 pieces	15 g
Olive oil	1 dessert spoon	5 g
Avocado	1/4 pieces	15 g
Butter	1 dessert spoon	5 g
Margarine (soft)	1 dessert spoon	5 g
Sunflower Seeds	1 tablespoon	10 g

Table 5. Meat Group

Meat	Average Measure	Amount (g)
Fish meat (lean)	About 1 meatball	30 g
White Cheese	1 matchbox	30 g
Steak	About 1 meatball	30 g
Turkey Meat	About 1 meatball	30 g
Cheddar cheese	2/3 of a matchbox	30 g
Minced meat	About 1 meatball	30 g
Meatball	1 piece	30 g
Cubes	3-4 pieces	30 g
Curd Cheese	2 tablespoons	30 g
Cutlet (boneless)	About 1 meatball	30 g
Chicken meat (skinless)	About 1 meatball	30 g
Egg	1 piece	30 g

Table 6. Milk Group

Milk	Average Measure	Amount (g)
Ayran	2 cups	320 g
Milk	1 cup	160 g
Yoghurt	1 cup	160 g
Kefir	1 cup	200 g

The data received is a sample protection diet list. Afterwards, tables indicating the types and portions of food that users should eat after the diet were taken.

If the body mass index value is below 22, the recommended change values are as follows: 3 changes in the milk group, 6 changes in the meat group, 4 changes in the bread group, 4 changes in the vegetable group, 2 changes in the fruit group and 4 changes in the fat group.

If the body mass index value is above 22, the recommended change values are as follows: 2 changes from the milk group, 5 changes from the meat group, 3 changes from the bread group, 3 changes from the vegetable group, 1 change from the fruit group and 3 changes from the fat group.

Data Required for Linear Regression

Among a total of 10 participants, 2 people with BMI values above and below 22 were selected and daily data were collected for a total of 30 days. Observations were made in May-June 2024. Participants entered their data themselves using the application. These data were used to determine the relationships between eating habits and weight during the post-diet maintenance period and a regression model was created. The accuracy of the model was assessed by low mean square error (MSE) and high R^2 score.

One meat exchange contains 6 grams of protein, 5 grams of fat and provides 69 calories of energy. A milk exchange contains 6 grams of carbohydrates, 4 grams of protein and 3.5 grams of fat and provides 71 calories. A butter exchange contains 5 grams of fat and provides 45 calories of energy. A bread exchange contains 15 grams of carbohydrates and 2 grams of protein, providing 68 calories of energy. One fruit exchange contains 12 grams of carbohydrates and provides 48 calories of energy. A vegetable exchange contains 6 grams of carbohydrates, 1 gram of protein and provides 28 calories of energy.

The regression model was constructed using the following independent variables:

- Meat consumption (30 grams) = 1 Change of meat
- Milk consumption (160 grams) = 1 Exchange milk
- Fat consumption (5 grams) = 1 Change fat
- Bread consumption (25 grams) = 1 change of bread
- Fruit consumption (100 grams) =1 Change fruit
- Vegetable consumption (100 grams) = 1 Change vegetables

3. FINDINGS

An application was coded in C# for the protection period tracking problem and real user data was obtained from this application. The number of changes given according to the BMI (Body Mass Index) value calculated using the data obtained from the user was used. 10 different users were tested. Nutrient changes such as meat, milk, etc. given between Tables 1 and 6 constituted the parameters of the problem. User information and nutrient change values are extracted from databases created using SQL. The user registers by entering his/her information on the sign-up screen. It switches to the change calculation tab and can see how much change is left from which food group by selecting the foods and portions consumed during the day. Among a total of 10 participants, 2 people with BMI values above and below 22 were selected and daily data were collected for a total of 30 days

Two studies were conducted for linear regression with Python coding, two linear regression models obtained as a result of 30-day data for BMI values above and below 22. When the correlation matrix for the relationship between nutrients and total calories is analyzed.

For those with a BMI below 22, the nutrient that most affects the total calorie intake and weight of the person during the day is meat. Meat is followed by bread, fruit, milk, vegetables and fat. When training the model, five models with test dimension 0.1-0.2-0.25-0.3-0.4 were run for training and test data. The most significant model is model 1 with an R2 value of 0.95 at a test size of 0.1. As a result of the regression analysis, it was found that the consumption of certain food groups had significant effects on weight. In particular, meat and bread consumption had more significant effects on weight.

For BMI over 22, the total calories and weight of the person during the day. The nutrient that affects the most is the meat exchange. The meat nutrient is followed by fruit, milk, bread, butter and vegetables. Training and testing when training the model on five models with a test size of 0.1-0.2-0.25-0.3-0.4 for the data was studied. The most significant model at test size 0.1, R2 value of 0.79with model 1. As a result of the regression analysis, it was found that certain food groupsconsumption has been found to have significant effects on weight. Especially meat and fruit consumption has been observed to have more pronounced effects on weight.

4. DISCUSSION

At the beginning of the project, an application aimed at facilitating the monitoring of the maintenance period was successfully designed. Individuals entered the details of their meals into the form application, which made it easier to track their maintenance period. During the regular diet phase, individuals are provided with ready-made diet lists, while during the maintenance period, they are only given information about the quantities they should consume daily, and they are expected to balance their intake accordingly. With the developed Windows application, users were able to log the items they consumed and achieve a balanced intake. The application, which is already functioning correctly, can be further developed with the addition of a database. For example, by adding a Dietitian module, users' data could be shared with a dietitian, enabling the dietitian to make adjustments or suggest different quantities for the user's consumption in other periods.

Another development option could involve offering sample menus based on the remaining exchange counts. For instance, if an individual needs to consume 5 portions of meat, 3 of vegetables, 2 of fruit, 2 of bread, 2 of fat, and 3 of dairy daily, and they consumed 1 portion of meat, 1 of vegetables, 1 of fruit, 1 of bread, and 1 of dairy at breakfast, the application could use the logged data to present alternative sample menus based on the remaining exchanges.

In the Windows form application, data for 30 days (from the same individual) was retrieved from the database, and multiple regression analysis was applied based on the individual's consumption. Regression analysis was performed for two users with different BMI values. This analysis supported the study by helping users better understand the relationship between their eating habits and weight changes. For users with a BMI value below 22, the R^2 value obtained from Model 1 with a 0.1 test size was 0.95, making it the most meaningful model explaining the relationship between nutritional components and total calorie intake. For users with a BMI value above 22, the R^2 value from Model 1 with a 0.1 test size was 0.79. Since these results are close to 1, it shows that both models are highly successful in estimating total calorie intake.

The effectiveness of the application was evaluated through the regression model, enabling users to monitor their adherence to the maintenance period program prescribed by their dietitian.

5. CONCLUSION

A new application has been developed to help individuals in the diet maintenance phase monitor the progress of their diets. Users can log the details of what they eat in a meal into the application, and it will instantly calculate the remaining quantities they can consume for subsequent meals. Since the data is stored in a database, a dietitian module can be added, allowing this information to be shared with a dietitian.

With the data stored in the application's database, the user's nutrition program can be adjusted on a weekly or daily basis by adding or reducing certain items.

In this study, data stored in the database for individuals with BMI values above and below 22 were analyzed. Using these data, a multiple linear regression model, a machine learning technique, was built to examine the impact of food groups (meat, dairy, fat, fruit, vegetables, and bread) on calorie intake. The results obtained optimized the individual's total calorie intake. According to the regression results, the R^2 value was 0.95 for the recommended model for individuals with a BMI value below 22, while it was 0.79 for those with a BMI above 22. As a result, the proposed regression model yielded statistically significant outcomes.

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Contribution of Researchers

Study idea: BA, Study design: SO, ZG, EF and EEY; Obtaining data: SO, ZG, EF and EEY; Analyzing data: BA, SO, ZG, EF and EEY; Creating the article draft BA; Critical review for content: BA, Final approval of the version to be published: BA.

Conflicts of Interest

Authors declared no conflict of interest.

Ethics committee approval

Ethics committee approval is not required for this study.

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