Calorie Management System for Healthy Lifestyle

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Abstract— In the world of 21st century it has become really essential to maintain healthy weight. If the body weight of a person is well maintained, it contributes to the overall health as well as prevents and control many diseases and complications. An overweight or obese person is at a higher risk of developing serious health problems. Healthy weight not only avoids the risk of having diseases but also provides a better physical personality which ultimately leads to a better lifestyle. Our body weight is directly affected by the energy we take and release, so it has become important to track the energy balance in our body. Energy is measured in terms of calories a person gains or loses. Most of the people are not aware how much calories they gain after a particular meal they have taken or the amount of calories they have lost after certain physical activity. The approach is to calculate the calorie intake and loss by maintaining records of the food intake and the physical activity of a particular person. A report can be generated based on the age, gender, height and weight of a person that shows how much calories a person should take and burn to gain or lose a certain amount of weight so as to maintain a healthy body weight. The calculation of calorie count is generated by Harris-Benedict Equation which is regarded as one of the most popular equations for determining the energy needs of a person by nutrition and health professionals.

Key words: Harris-Benedict Equation

I. INTRODUCTION

Weight management is one of the most essential activities in a healthy lifestyle in today's world. Calculating the calorie intake and loss is the main aspect of tracking our weight. The manual tracking methods of dieting or weigh gaining requires the individual to have the knowledge of the nutritional contents of edible items and the proportion in which they must be taken. Lack of sufficient knowledge can lead to delays in expected results and in worst case the results are not even achieved. A few people have the knowledge of calories, fats and energy that a particular meal contains and a person who does not have the idea of this may loss the track of controlling his diet during his busy schedule.

Although internet today does provide a lot of information regarding the nutrient values of different food items and the effective ways for burning calories, not everyone is able to keep track of this information and actually remember it. This leads to distributed results. Some people find it difficult to follow all this information and some just don't get the expected results which leads to disappointment. As a result people give up their hopes for a healthy lifestyle and stop following the healthy measures they had started.

II. SYSTEM OVERVIEW

Human body is a very complex and fascinating design. Each and every individual has a different body structure. All of them require to consume and burn different amounts of calories to maintain their structure. Different techniques are used to calculate the calories consumption for various structures. Studies have shown us that various factors are responsible for this distributed pattern of calorie consumption in humans. The factors that directly affect calorie consumption include age of a person. The age group that the person belongs to directly affect the diet that the person should consume. Gender is also one of the factors that calorie consumption depends on. Females require less calories as compared to males. The physical characteristics also contribute to the variation in diet structure. The prime attributes of those are given as the weight and the height of a person. These characteristics are directly proportional to the calorie consumption of the person. Another major factor that affect calorie consumption is the daily activity performed. More physical activity leads to more calorie consumption and the less a person is active, the less is the consumption.

Nevertheless, a person can get confused regarding the diet intake. This can result in improper consumption of calories which ultimately leads to imbalance of body weight. This imbalance can be corrected with proper intake of calories.

III. LITERATURE SURVEY

Here is the list of popular equations and algorithms used in the implementation of the system.

A. Harris-Benedict Equation

Harris-Benedict Equation is one of the most popular equations to calculate the Basal Metabolic Rate (BMR) given by James Arthur Harris and Francis Gano Benedict, which was published in 1919 by the Carnegie Institution of Washington in the monograph 'A Biometric Study of Basal Metabolism in Man'. Basal Metabolic Rate (BMR) is the rate at which body uses the energy to keep up breathing and maintaining body temperature while at rest. This BMR is then multiplied with the Physical Activity Level (PAL) to calculate the Total Energy Expenditure (TEE).

The Total Energy Expenditure can be calculated as follows.

1) Let us assume that the data is in metric unit, 'age' is the age of the person in years, 'height' the height of the person in centimetres, and 'weight' is the weight of the person in kilograms, then the Basal Metabolic Rate can be given as

For male

$$BMR_m = 66.5 + (13.75 \times weight) + (5.003 \times height) - (6.755 \times age)$$

For female

$$BMR_f = 655.1 + (9.563 \times \text{weight}) + (1.850 \times \text{height}) - (4.676 \times \text{age})$$

and if person provides the data in US units, assume that 'age' is the age of the person in years, 'height' the height of the person in inches, 'weight' is the weight of the person in pounds, then the Basal metabolic rate can be given as

For male

$$BMR_m = 66 + (6.2 \times \text{weight}) + (12.7 \times \text{height}) - (6.76 \times \text{age})$$

For female

$$BMR_f = 655.1 + (4.35 \times \text{weight}) + (4.7 \times \text{height}) - (4.7 \times \text{age})$$

2) After calculating BMR, the TEE can be calculated by the multiplying PAL to BMR. Physical Activity Level can be categorized as 'Sedentary or Lightly Active', 'Active or Moderately Active' and 'Vigorously Active'. 'Sedentary or Lightly Active' can be explained as office worker with very little or no exercise whose PAL is 1.53. 'Active or Moderately Active' can be explained as construction worker or person running one hour daily whose PAL is 1.76. 'Vigorously Active' can be explained as agricultural worker (non-mechanized) or person swimming two hours daily whose PAL is 2.25.

$$TEE = BMR * PAL.$$

B. World Health Organization Equation

The equation for estimating the calorie need was developed by WHO in 1980, they did not feel that the height is necessary to calculate the BMR. Although they divided the age group for which the formulae are modified.

1) Age 3-9 Years

For male

$$BMR_m = 22.7 \, x \, (\text{Weight in } kg) + 495$$

For female

$$BMR_f = 22.5 \, x \, (\text{Weight in } kg) + 499$$

2) 10 to 17 Years

For male

$$BMR_m = 17.5 \, x \, (\text{Weight in } kg) + 651$$

For female

$$BMR_f = 12.2 \, x \, (\text{Weight in } kg) + 746$$

3) 18 to 29 Years

For male

$$BMR_m = 15.3 \, x \, (\text{Weight in } kg) + 679$$

For female

$$BMR_f = 14.7 \, x \, (\text{Weight in } kg) + 496$$

4) 30 to 60 Years

For male

$$BMR_m = 11.6 \, x \, (\text{Weight in } kg) + 879$$

For female

$$BMR_f = 8.7 \, x \, (\text{Weight in } kg) + 829$$

5) Above 60 Years

For male

$$BMR_m = 10.5 \, x \, (\text{Weight in kg}) + 596$$

For female

$$BMR_f = 13.5 \, x \, (\text{Weight in kg}) + 487$$

These BMR are then multiplied by same PAL to get TEE.

C. Mifflin-St. Jeor Equation

In 1990 Mifflin-St. Jeor developed an equation and became very famous among the nutrition professionals and diet experts. The equation is given as

For male

$$BMR_m = 10 \, x \, (\text{Weight in kg}) + 6.25 \, x \, (\text{Height in cm}) - 5 \, x \, \text{age} + 5$$

And for female

$$BMR_f = 10 \, x \, (\text{Weight in kg}) + 6.25 \, x \, (\text{Height in cm}) - 5 \, x \, \text{age} - 161$$

These BMR again multiplied by same PAL to get TEE.

IV. PROPOSED METHODOLOGY

The proposed methodology for weight management only requires a smart phone in which the user can install the mobile application. The application uses the algorithm and appropriate equations to find out calorie consumption based on provided input. It also gives the calorie count to be consumed for weight gain or loss per week. Fig. 1 shows Use Case diagram of the proposed system.
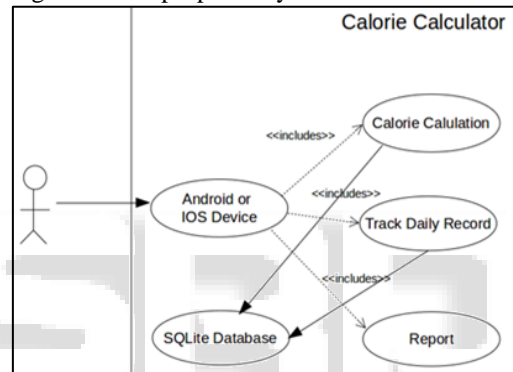

Fig. 1: Use Case Diagram of the System

The system calculates the daily calorie consumption of the person with the help of the nutritional value data maintained and the user data input of the meal intake. The system also keep track of the calorie loss if the person performs a physical activity apart from its daily routine. By using this application, the person can manage his calorie consumption and accordingly control the diet and increase the daily exercise based on the results he want to achieve. The user is provided with the list of food items along with their nutritional contents per quantity as well as information regarding the amount of calories burned in various physical activities such as running and swimming so that the person can accurately know the actual calorie gain or loss and keep track of the progress.

V. SYSTEM IMPLEMENTATION

The implementation of weight management application is divided into three parts - Calculation of how much calorie per day required for a person, Report generation of how much calorie per day required to gain or lose weight per week, Keep track of how much calorie does person consume or gain per day.

A. Calculation of How Much Calorie per Day Required for a Person

Calculating how much calorie a person requires to maintain his weight is the basic functionality provided in the system.

The person is expected to provide his details like weight, height, gender, his daily physical activity and his age. After obtaining these details the system applies Harris-Benedict equation to calculate Basal Metabolic Rate (BMR) of the person. After calculating BMR of the person, his Total Energy Expenditure (TEE) is calculated by multiplying BMR to daily physical activity i.e. Physical Activity Level (PAL). This gives actual calorie per day required by the person. Fig. 2 shows the form to enter the user details.
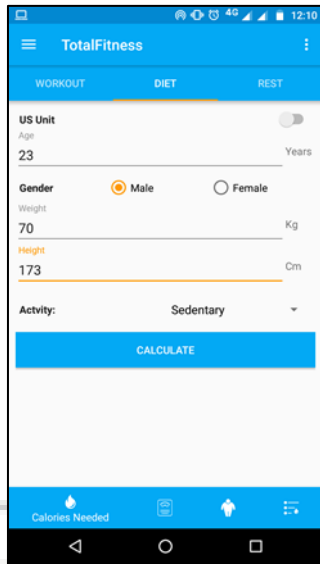

Fig. 2: Calculation of How Much Calorie per Day

B. Report Generation of how much Calorie per day Required to Gain or Lose Weight per Week

The report of calories per day required for gain or lose weight per week is generated based on the TEE. For gaining half kilogram of weight in one week, $\text{TEE} + 500$ Kcal is required and for gaining one kilogram of weight,

$\text{TEE} + 1000$ Kcal is required. For losing one kilogram of weight, the person needs $\text{TEE} - 1000$ Kcal per week.

This formula can be used to calculate the calorie intake per day for a person so that he/she can gain or lose desired amount of body weight. Fig. 3 shows the generated report for how much calorie required for gaining and losing the weight per week of a person.

Fig. 3: Report Generation of Calories Consumed per Day

C. Keep Track of how much Calorie does Person Consume or Gain per Day

The user has to maintain a record of the food items consumed in the application itself. The system has the information of common food items which person may consume along with the actual calorie content of that item. The user is expected to select the item and enter quantity of that item consumed. Based on the provided data, the system will calculate the calories gained or lost by the person on that day. The user can also enter the physical activities done and the time for which the person did that activity which helps the system to calculate the amount of calories burned. The entered data is stored in the system for further calculations of the predicted and the actual results after certain weeks, months and years.
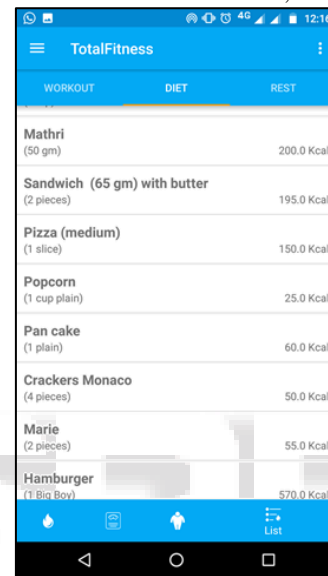

Fig. 4: List of Food Items with their Nutritional Contents

VI. CONCLUSION

The paper presents a system of calorie management that calculates calorie consumption required for a day based on Harris-Benedict equation. This algorithm is simple and has high accuracy rate, and easy to implement. The main objective of the study to help the users achieve a healthy lifestyle and improving their physical personality. This method of maintaining weight does not require any complex algorithm and mechanism. A smartphone is the only requirement for the system which most of the people have in their pockets every time. The user needs to know his physical measurement like weight, waist measurement, height etc. and enter the data correctly. All the calculations are performed by the system and the results are displayed accordingly. The user is constantly notified about his daily progress. In future work, the authors intend to improve the proposed system by making it compatible with a fitness tracker device. This will automate some of the data entry in the system to its accurate values like running and walking step-count, sleep time, and amount of water drank, thereby increasing the efficiency of the system significantly.

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