SEARCHING MODEL AND RECORDING OF BODY COMPOSITION TO ANDROID BASED BODY FAT NEED

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1. Abstract

In the current era of the Industrial Revolution 4.0, forcing humans to think and do more than before, so that humans themselves forget the nutritional needs or energy needed by their bodies so that humans become weak or even suffer from fatigue. Data on body composition and body fat requirements are required to meet a person's body intake needs. In this study, how to help with calculations by modeling the search and recording of body composition and fat conditions using Firebase. With Firebase, it is beneficial in doing mathematics and storing data from that person.

Keywords: Firebase, Nutritional Needs, Body Pattern.

1 Introduction

Mensana In Corpore Sano (in a healthy body, there is a healthy soul) is a health motto agreed upon in this life. To keep the body in shape and healthy but also to maintain togetherness in this life. Advances in Information Technology that exist today make workers' mobility so high that it makes them forgetabout their body intake needs and often suffer from illnesses at a young age. When seen in offices, it isnot uncommon for these workers to be busy with their work because they must be on time targets. After all, this is a responsibility that must be carried out as workers in the companies that employ them, and it's not uncommon for these jobs to be taken home so that they can be completed. At home as hisresponsibility. That is a factor to forget about themselves and about the need for their body's intake thathas worked for many hours which can have an impact on decreasing work productivity due to forgettingthat they need to replenish their body intake and exercise for a while, so that the bodies can be refreshed. It is not uncommon for these workers to read less information about how to refresh the body that has worked for hours. Many uses other food (supplements) to maintain work stamina but maintain the

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body by consuming fresh and healthy foods and exercising 10 minutes to relax the body during working hours to provide better freshness.

Maintaining health so that you don't get sick quickly is often sought by looking for high activity and active people vulnerable to various diseases. People take 10 minutes to exercise and eat fresh, fiber foods at certain times of the day. Therefore, it is imperative for those who are active and have high mobility to pay attention to their health because very busy people will tire quickly. When the body is tired or tired, the immune system will weaken, and when the immune system is weakened, various diseases will enter the body. People who are busy with their work will find it challenging to regulate their sleep patterns so that when someone has a little sleep at night, they will be susceptible to various diseases. Not only that, people with high levels of activity are often exposed to stress, where stress is the leading cause of various serious illnesses (Medic, W. et. al., 2017).

This modeling and calculation results will result in the body composition of the body's fat needs so that workers have an ideal body with high stamina and new conditions. It reminds us of the activities carried out by a worker who has high mobility to maintain his life to stay fresh, such as exercise and intake, to give the body a prime condition.

The variables that can be used to perform calculations as the required reference calculations: age, weight, height, neck circumference, abdominal circumference, and hip circumference. From this data, estimates are made to produce a Basal Metabolic Rate (BMR) and Body Mass Index (BMI), which can be used to determine or maintain body balance. Utilizing firebase from Google services can provide convenience in developing applications and a real-time database that can be used to store data and be synchronized to its users.

2 Method

To be able to support the modeling and calculation of body composition and body fat requirements, data is needed, which can be obtained through observation and data filling of existing workers, while application modeling is to support the application to be used, namely Firebase, because it can provide exciting features such as Sharma, D., Dand, H. (2019).

Analytics is a feature required for data collection and reporting purposes for Android or iOS applications with variable data. Cloud Messaging and Notifications, with its Firebase Cloud Messaging (FCM), can provide push notifications and create two-way communication between devices using the Extensible Messaging and Presence Protocol (XMPP) and Hypertext Transfer Protocol (HTTP). Firebase Remote Config is a feature that gives access to make configuration changes in the Android or iOS application without having to update the application on the play store application. Crash Reporting is a service used to record any exceptions that occur in the application, and Real-Time Database is a feature widely used by users because the applications developed could be accessed directly by the user.

Body composition is the relative proportion between fat tissue and lean tissue in a person's body. It is said that the body composition consists of two parts, namely fat deposits (adipose tissue) and fat-free tissue (lean tissue). Fat-free tissue is said to be very active in metabolic processes in the body. Meanwhile, the fat storage network, or adipose tissue, serves to store energy reserves Prado C. M. M. *et al.*, 2014).

Body composition is the amount of fat tissue mass and fat-free tissue present in the body. Fat-free tissue itself is a tissue consisting of muscle, bone, protein, and body fluids. Meanwhile, fat is water-free tissue, so that less fat will increase the percentage of water in a person's body (Zierle-Ghosh and A., Jan, A., 2020).

When trying to be healthier, you will likely lose fat and gain muscle, but BMI and the scale do not differentiate between muscle and fat, so this is done through body composition analysis. Fats are

substances that are difficult to dissolve or break down by the water. These fats are formed from two types of molecules, namely fatty acids and glycerol, the types and levels of these fatty acids that determine the impact of fat in the body (Ristati, L., *et al*., 2017).

Fat in adipose tissue can be used at any time when the body needs it through the process of lipolysis in the cytoplasm. Lipolysis converts triglycerols into fatty acids and glycerol. The glycerol produced is then used for the glycolysis process. Glycolysis is the first process of breaking down glucose into the energy your body needs (Nutrition, 2020).

Body fat is needed by the body, which functions as an energy reserve required by the body. The presence of excessive body fat can cause problems in the body, so a proper balance of body fat levels is needed to provide a body fitness pattern. This body fat cannot be seen from the body size or design because not all thin people are free of grease. Even in a light body pattern, unexpected fat deposits can occur. The presence of excess fat in the body can endanger the health and cause diabetes mellitus (DM), heart disease, and impaired liver function (Frank, Q., Nuttall, M. D., 2015).

BMI or Body Mass Index (BMI) is used as a comparison ratio for indicators in determining the BMI of the body. BMI calculations can be done by dividing body weight (kg) to height (cm) squared (William, C. *et al*., 2011). This BMI value is the standard or indicator used to see someone in good health or not. The pattern used to view BMI someone is:

$$\text{BMI} = \frac{\text{BB}}{(\text{TB})^2}$$

Where is: BB = Body Weight (Kg)
TB = Height (Cm)

As for the scale of the calculation results with the table results of the BMI scale, as follows:

Condition	Kategori	IMT
Thin	Lack of weight level of weight (very thin)	< 17,0
	Mildly underweight (thin)	17.0 - 18,4
Normal	Ideal body balance	18,5 - 24,9
Fat	Mild overweight	25.0 - 27,0
	Being overweight (obesity)	> 27.0

Table 1: **BMI Scale**

In this study, the search for body fat content will use a formula that has been determined from the Binaraganet. The formulas used are different for male and female sex. Then there are also 2 formulas for each gender, and the final result is the average of the two formulas: a. Body Fat levels for Men:
1. KLTL1 = 86.01*Log10((LP – LL)/2.54) – (70.04 * Log10(TB/2.54)) + 36.76

2. KLTL2 = ((BB * 2.2 - ((BB * 2.2 *1.082) + 94.42 + (LL * 0.35/2.54) – (LP * 4.15/2.54))) * 100) / (BB*2.2)

b. Body Fat levels for Women:

1. KLTP1 =163.205 *log10((LP + LPg – LL)/2.54) - (97.684*log10(TB/2.54)) - 78.387

2. KLTP2= ((BB*2.2 - ((BB * 2.2 * 0.732) + 8.987+(LL*0.3/2.54) - (LP*0.157/2.54) – (Lpg * 0.249/2.54))) *100) / (BB * 2.2).

Where: LL = Neck Circumference
LP = Stomach Circumference
LPg = Hip Circumference

So, the condition of body fat levels obtained based on TLC and KLTP is the total fat available compared to all organs and body fluids. Natural fat owned by each man is 2-4%, and for women, it is 10-12%, and the rest can be obtained from food and drinks consumed. The problem is how much fat is expected in a person's body?

According to the American Council in determining the percentage of a person's normal body fat condition, are:

- Total fat for female athletes is 14 - 20% and for male athletes it is 6 - 13%
- Those who are active in sports and not athletes for women are 21-24% and for men are 14 - 17% • Those who rarely exercise but their body fat is still considered normal and healthy, for women it is 25-31% and for men it is 18-25%
- Those who are declared obese, for women it is more than 32% and for men it is 26% and this condition is prone to suffering from chronic diseases such as diabetes, stroke, heart attack, coronary heart disease or other diseases.

To calculate the Basal Metabolic Rate (BMR) in kcal / day units, is:

1. BMR for men = 88.362 + (13.397 x BB kg) + (4.799 x TB) – (5.677 x age)
2. BMR for woman = 447.593 + (9.247 x BB) + (3.098 x TB) – (4.330 x age)

System Flowchart

Flowchart is a chart with certain symbols that describe the sequence of processes in detail and the relationship between a process (instruction) and other processes in a program.

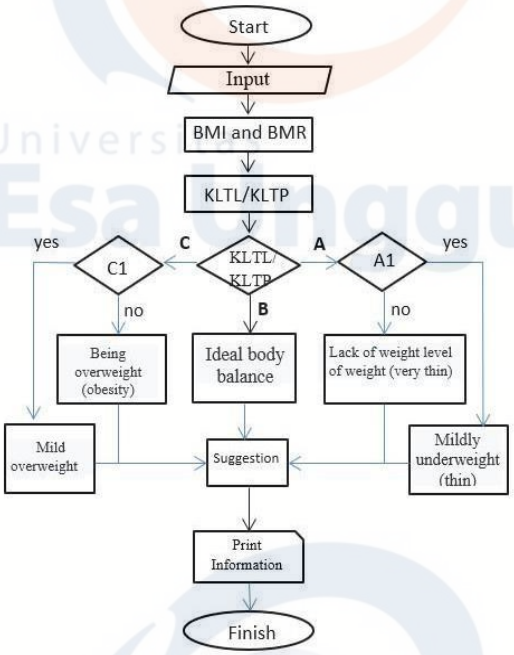

Figure 1: Flowchart of KLTL / KLTP Calculation

3 Results and Discussion

From the research method above, there are 2 users of this system, namely: Admin and the object (the person whose body fat component is measured). This function is made to solve the problems and needs faced in this study.

The inputs used in this system are Age, BB, TB, LL, LP and LPg. After that, the BMI, BMR and KLTL or KLTP are calculated. For men using KLTL and for women it is KLTP. If the calculation results from KLTL / KLTP produce:

2. Then someone was in the thin zone, and this skinny is divided into two more, namely: if the condition of the body in A1 is "yes," then the person is "low in weight with a light level of BB," and if not then that person is declared "Lack of weight (thin)" in which the body composition with body fat requirements is not balancing or lack of body fat.
3. Then someone is declared "Ideal body balance," in which the condition is balanced between body composition and body fat needs.
4. Then a person in the fat and fat zone is divided into 2, namely: If the shape of his body in C1 is "yes," then that person is "lightly overweight." If not, then that person is declared "overweight (obesity)," where the body's composition with the needs of body fat is not balanced or excess body fat.

From the results of these calculations, suggestions will be given to have an ideal body composition for body fat or provide new conditions. The products are printed so that someone can understand the comparison between body composition and body fat condition. The results of this calculation can be stored in Firebase. They could also display the results of previous analyses. It could be done again from the beginning of filling in new user data and then running it to obtain the body composition of a person's body fat.

Blackbox Testing

It aims to test it as a whole based on input and output without seeing in detail the coding problems of the system. This calculation test is to see if this system works normally and does not produce errors.

The tools used to calculate this are:
Testing was carried out on Xiaomi Redmi 5a, with:

- Android ver. : 8.1.0 (Oreo)
- Rom: MIUI Global Ver 10.3.2
- CPU: Quad-core 1.4 Ghz
- RAM: 2.00 GB
- Special Settings: Animation is disabled. From the results of this Blackbox test:

No.	Needs	Result	Notes
1.	Input data on male and female bodies, among others: Age, BW, TB, LL, LP, LPg	Ok	There is no
2.	Calculating the body composition of BMI, KLTL, KLTP	Ok	None
3.	Can save calculation results	Ok	Nothing
4.	Can delete the calculation results	Ok	Nothing
5.	Displays a list of previous calculations	Ok	
6.	Can display detailed calculation results	Ok	
7.	Can display body composition scale graph according to the specified scale	Ok	
8.	There is an explanation of each body composition and an explanation of the scale	Ok	
9	There is a graph showing the development of body composition. Graph displays each body composition in the last 5 or less calculations.	Ok	The graph library cannot have only 1 record

Table 2: Blackbox Test Result

Testing Using Sample Data

This test uses sample data from a system user, who sees the accuracy of the calculations from this application:

Sample Data Attributes

Gender	: Male
Age	: 25 years
Body Weight (BB)	: 70 Kg
Height (TB)	: 178 Cm
Abdominal Circumference (LP)	: 96 Cm
Neck Circumference (LL)	: 50 Cm

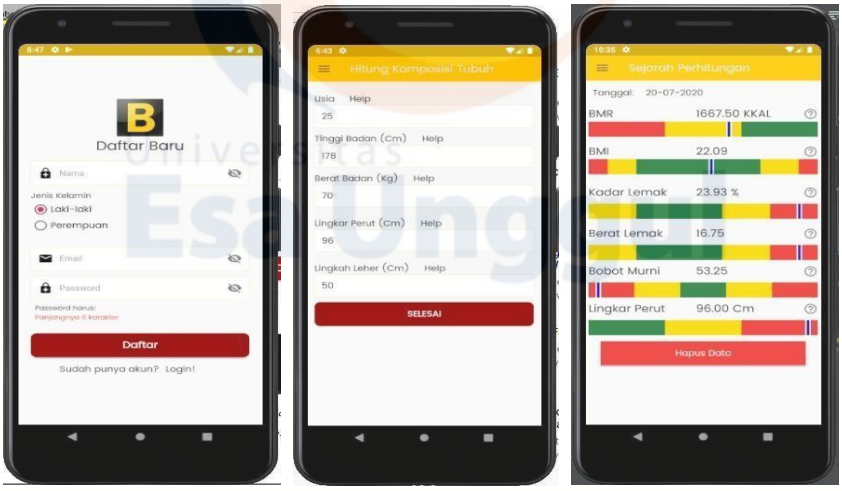

Figure 2: Application View

4 Conclusion

Based on the calculations made for a user, the user knows the Body Composition condition with the Body Fat Needs in his body so that the user can find out what is being done to maintain his stamina. The tests carried out resulted in no errors that occurred in this application and gave appropriate results. Then using Firebase makes it easy to build a pretty good application.

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