

# The Development of *DIETDUCATE*: An Android Based Diet Management Application to Educate Ideal Diet Recommendation

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## ABSTRACT

Indonesia is now facing the triple burden of malnutrition. Undernutrition in terms of underweight, stunting, and wasting, overweight and over-nutrition, and micronutrient deficiency still become a concern to be tackled. In this 4.0 industrial era, where people using gadget more often, an approach to educate the correct diet based on evidence based is needed. To face such challenge, we develop an android based application that mainly aims to educate its user how to do the right diet. The use of an android based application is easier and faster compared to website. This study aims to develop intelligent application of nutrition education and help achieve ideal body weight in people with malnutrition (under and over-nutrition) and analyze its usefulness. This was an experimental study design using the waterfall method which consists of requirements engineering, design and implementation, testing, release and maintenance stages. After the android application development has been completed, then proceed with the survey stage. The survey was conducted using usability testing with the USE Questionnaire. The development of a diet management application can be accepted by the general public starting from high school or equivalent and above. This android based application also proved to provide a good experience for its user, as indicated by the average assessment of its usability, satisfaction and ease of the users that is more than 80 percent. *DIETDUCATE* android based application can be used as a practical, easy and attractive mobile application and helps the community in managing body weight.

**Keywords:** android application, digital health, nutrition education, overweight, underweight

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## INTRODUCTION

Obesity and undernutrition are some of the most crucial health problems faced in Indonesia. The prevalence of obesity worldwide increased 3-fold between 1980-2016. In 2016, more than 1.9 billion adults from over 18 years were overweight<sup>1</sup>. While around 1.7 billion people still suffer from malnutrition, most of them are in developing countries<sup>2</sup>. Based on National survey, the prevalence of obesity in 2018 has increased by 21.8% from 14.8% in 2013. Then the prevalence of undernutrition was 11.1% and mostly experienced by teenage age group. The existence of these nutritional problems (under and over-nutrition) are commonly referred to as double burden of malnutrition. The impact of obesity and undernutrition is increased risk of non-communicable diseases and mortality<sup>3</sup>. Multiple nutritional problems that often occur in adolescence age are caused by incorrect lifestyle factors and dissatisfaction with the desired body image<sup>4</sup>. As a result, some of teenagers practicing unhealthy eating patterns to achieve the desired body shape. Many adolescents restrict eating patterns for fear of being fat, and some of them who lack of health awareness and tend to be overeat which could cause obesity<sup>5</sup>. Those behavior has a negative impact on health, especially nutritional status in adolescents' due to an unbalanced nutritional intake compared to the recommended adequacy<sup>6</sup>. A disturbance in adolescents' nutritional status could bring several health consequences in later life, such as chronic

energy malnutrition, infertility, even worse it could cause early onset of non-communicable diseases.

The problems mentioned above need proper dietary advice in accordance with the advice of a nutritionist. Nutrition problem solutions should follow technological developments, where the development of knowledge and technology in the world when undergoing changes in the 4.0 industrial revolution<sup>7</sup>. Recently, there was a nutritional consultation website that can be used as well as a food database to help with diet planning and evaluation. An online nutrition consultation helps in nutrition services so that they can play an active role in disease prevention efforts and support healthy lifestyle<sup>8</sup>. The nutritional consultation process is also carried out the process of regulating dietary patterns through the selection of food ingredients that can be included in the Indonesian food composition table online.

The use of online media is now the main access for young people in addition to being easier and more efficient in its use. The problem that occurs now is the use of two websites at the same time became less efficient for most of the users. The use of an android based application can be used as a media to access information easily and quickly. Multiple nutritional problems that often occur among adolescents are very appropriate with adolescent lifestyle habits that cannot be separated from the use of smartphones as entertainment, needs and trends alone<sup>5</sup>. The importance of combining two websites in the form of an android application to be more efficient and effective, independent

in its users, the form of an application that is simple and very practical to be accessed anywhere and anytime because it is connected directly to the internet. Based on our knowledge, in Indonesia, there was no android-based application that aims to help users in planning their diet. Thus, we aim to develop an android based diet management application and assess its usefulness, satisfaction and feasibility to use.

## MATERIALS AND METHODS

### Research Design

This research was using a combination of experimental and survey design. Experimental phase was the development of android based weight management application. This method is usually used to develop a new product or enhance existing products with accountable steps<sup>9</sup>.

### Materials and Methods

The development of this application is basically a continuation from a web-based nutritional consultation research<sup>8</sup> and a web-based food database<sup>10</sup>. This research was carried out at the Software Engineering Laboratory, Department of Information Technology, State Polytechnic of Jember, Indonesia. This research was conducted in two stages, namely application development and application evaluation. Application development uses the waterfall method, which consists of requirements engineering, design and implementation, testing, release and maintenance stages (Fig 1.)<sup>11</sup>.

After the application development has been completed, then proceed with the survey stage or application evaluation. The survey was conducted using usability testing with the USE Questionnaire. USE questionnaire covers three aspects, namely usefulness, satisfaction and ease of use. Usefulness of the developed application was asked using six questions (it helps me be more effective, it is useful for me, it gives me more control over the activities in my life, it makes the things I want to accomplish easier to get done, it saves me time when I use it, it meets my needs and it does everything I would expect it to do); satisfaction was scored using six questions (I am satisfied with it, I would recommend it to a friend, it is fun to use, it works the way I want it to work, I feel I need to have it, it is pleasant to use). For the ease of use, ten questions were asked (it is easy to use, it is simple to use, it is user friendly, I can use it without written instructions, it is consistent in giving information, both occasional and regular users would like it, I can use it anytime and less effort, I learned to use it quickly, I easily remember how to use it, it is easy to learn to use it, I quickly became skillful with it).

### Data analysis

Data was analyzed descriptively for each variable based on the USE questionnaire.

### Ethical Clearance

This study was ethically approved by the Health Research Ethics Committee, Faculty of Public Health, Universitas Airlangga (IRB number: 27/EA/KEPK/2020). Informed consent was given to all participants before the study conducted.

## RESULT

### 5.1 Application Development

The development of android based weight management application was intended to make it easier for users to understand a correct weight management using evidence-based research. We developed an android based weight

management application called "*Dietducate*" with an easy and practical display, as well as the placement of features or menus on the content. The development of the *Dietducate* android based application was used to facilitate someone in setting a diet program or helping someone to lose weight or gain weight. Figure 2 below shows the initial appearance of the *Dietducate* application which we made as simple as possible so that people become more enthusiastic in using the *Dietducate* application. The initial page was made so that the user does not need to register manually, but directly through logging in to an account that most people already have, namely Google email or Facebook social media.

Figure 3 demonstrate some feature of *Dietducate* application including nutrition consultation program, nutritional content values in several food ingredients, nutritional calculations (BMI, BMR, so on), nutrition articles, registration of Nutritionists and online stores. By putting several contents in one stop application could help its user to have better understanding of weight management.

### 5.2 Evaluation of *Dietducate*

The respondents of this study are high school students or equivalent, college students and nutritionists who are currently or have taken formal nutrition education (diploma, bachelor, master, and doctoral program) from various polytechnics and universities in Indonesia. Before filling out a research questionnaire, respondents are first required to install and use the *Dietducate* application in their phone. Most of our subjects were female (86.8%) and a having higher education (85.0%). Characteristic of the subject presented in table 1.

Table 2 shows the respondents' judgment on the usefulness of developed *Dietducate* application, it can be seen that all questions scored more than 61%, which means that the users think that *Dietducate* is useful for them. The revelation item with the highest score was "*Dietducate* is useful to me" (90.5%). While the question of "*Dietducate* items in accordance with the expectations of respondents" had the lowest score of 83.2%. Nevertheless, it is still classified as good or useful.

Table 3 shows the respondents' ratings on the satisfaction of the *Dietducate* application, it can be seen that all questions scored more than 61%, which means the *Dietducate* application provides satisfaction for respondents. The revelation item with the highest score "*Dietducate* is fun to use" (87.8%). Whereas the statement "I am satisfied with *Dietducate*" had the lowest score of 84.1%.

Table 4 shows the respondents' assessment of the 10 statement items regarding ease of use and learning of the developed *Dietducate* application. It can be seen that all statement items scored more than 61%, which means the *Dietducate* application provides convenience for respondents to use. The revelation item with the highest score, the statement of "*Dietducate* is easy to use and *Dietducate* is practical to use" both scored of 88.9%. While the statement "I can use *Dietducate* any time smoothly" has the lowest score of 82.7%.

Based on the average score of the three assessment criteria that have been carried out for usability testing of the *Dietducate* application using the USE Questionnaire method; usefulness, satisfaction and ease of use, all three have a range of values of 80%, categorized as a good application.

## DISCUSSION

*Dietducate* application is an application that helps users in managing weight loss and weight gain properly. The application and design will then enter the evaluation phase, in which the application was tested on users who are dominated by the high-school students or equivalent, college students and nutritionists. Stages of application evaluation revealed that more than 80% of its users think that *Dietducate* application is useful, satisfied, and easy to use. The developed *Dietducate* application can be used as an application that is easy to operate and has a level of self-satisfaction in users<sup>13</sup>.

In the highest aspects of ease of use and learning, the statement "*Dietducate* is easy to use and *Dietducate* is practically used" having the same score. The *Dietducate* application is designed in such a way that it is easy to learn by the public. The ease of use of the application contributes to the eligibility of the application. Perceived ease of use defined as the degree to which an individual believes that using a particular system would be free of physical and mental effort<sup>14</sup>. The statement can be interpreted as the level where individuals believe that using a particular system will be free of physical and mental effort. This opinion can be measured through indicators or items on statements such as easy to learn, ease of achieving goals (controllable), clear and easy to understand (clear and understandable), flexible, and easy access<sup>15</sup>.

In the assessment of usefulness with the highest score is on the statement "*Dietducate* is useful for me". With the development of android-based applications, we expect to help its user in choosing the right and proper weight management program for each individual and prevent the failure of diet control<sup>16</sup>. In addition, android is useful for users because it can be used in the future to maintain ideal body weight and dietary records<sup>17</sup>.

The satisfaction aspect with the highest score on the statement "*Dietducate* is fun". The attractive appearance of the *Dietducate* application in terms of color, text and menu layout were contribute to a pleasant experience for the user. In making an application, there are two things that need to be considered, namely the layout and design of the application. Layout is the process of structuring the content or arrangement of objects contained in an Application page, while design is the process of imagination and creation of a person or application maker in expressing work and creating a beauty, by paying attention to aesthetics and high artistic ideals. Layout includes the arrangement and division of places on a page. A good and easy to understand layout and layout can make the page look more attractive, neat and balanced, making it fun to see and easy to read<sup>18</sup>.

There needs to be development for further research using other questionnaires such as SUMI or QUIS to evaluate applications. This is needed to provide a different perspective on the assessment of the application<sup>19</sup>. Our study presents a strength in terms of its novelty stating a digital health for weight management. However, several limitations also noted in our study including small sample size.

## CONCLUSION

The development of android based weight management applications can be accepted by the general public starting from high school or equivalent and college educated. Most of the users also satisfied with the developed application as indicated by the average assessment of usability, satisfaction and ease of use aspect by more than 80%. In this system, it is necessary to develop in the form of

providing access for Nutritionists to be able to enter nutritional value of specific food or food products. Entering more food's nutritional value could benefit the application's user. Verification by experts is also needed to ensure the nutritional value that is included, the articles published in this application are in accordance with evidence-based standards.

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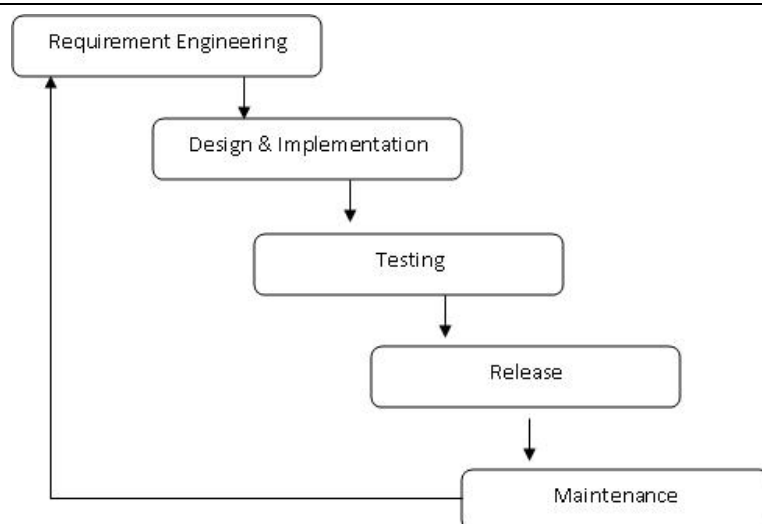


Figure 1. Waterfall method<sup>11</sup>

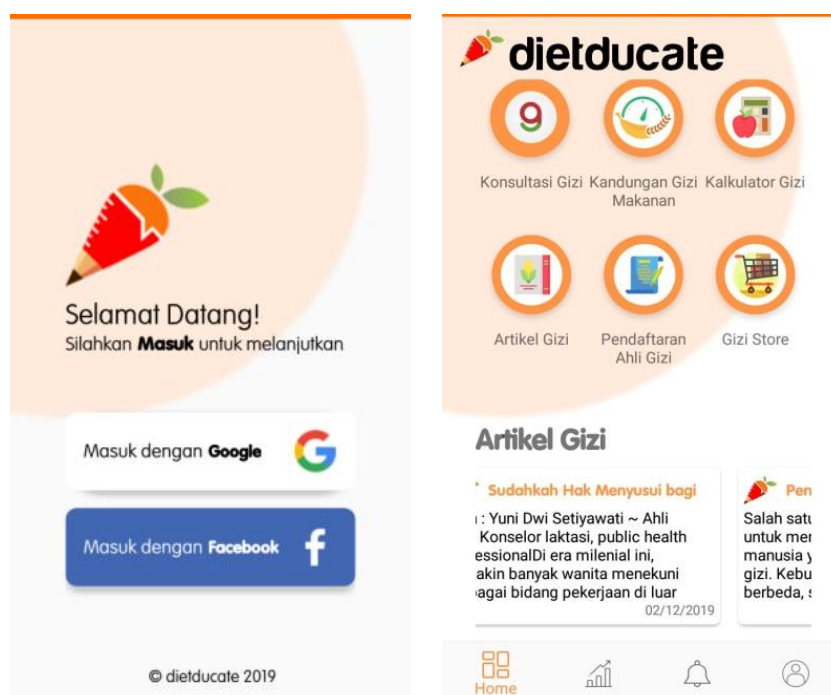
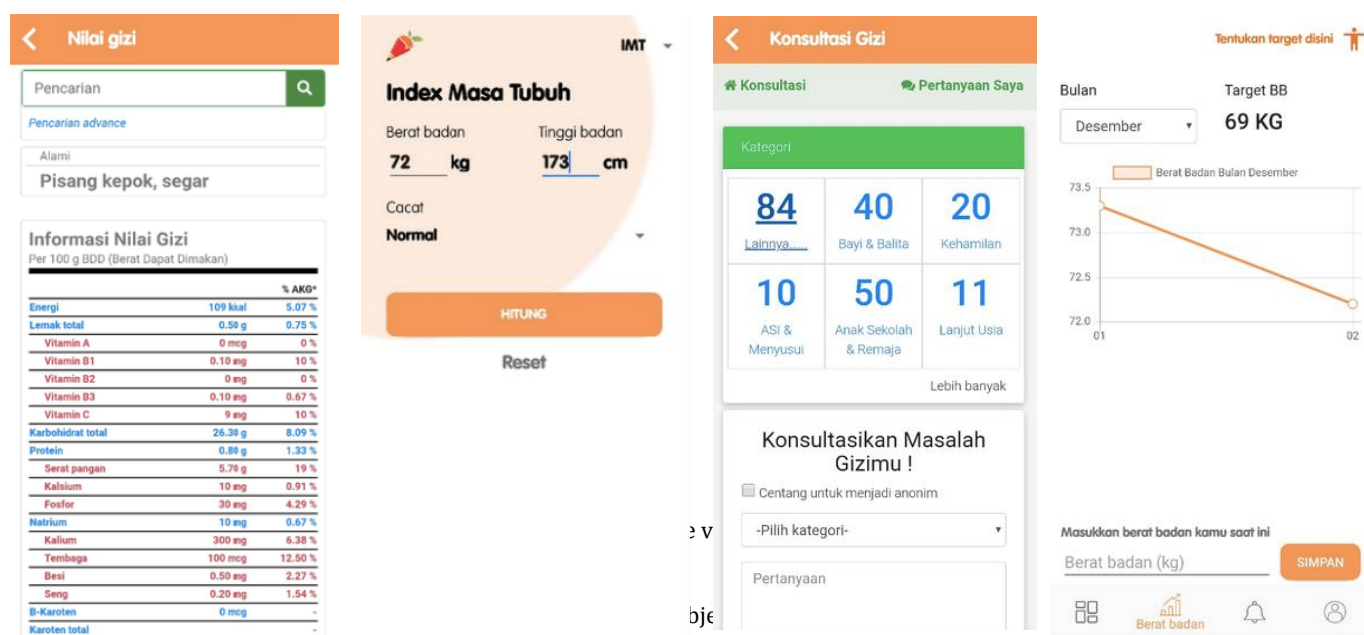


Figure 2. Initial page of *Dietducate*





Characteristic	Frequency (n)	Percentage (%)
<b>Sex</b>		
Male	7	13.2
Female	46	86.8
<b>Educational background</b>		
High school/equivalent	8	15.0
Higher education	45	85.0

**Table 2.** Usefulness questionnaire score

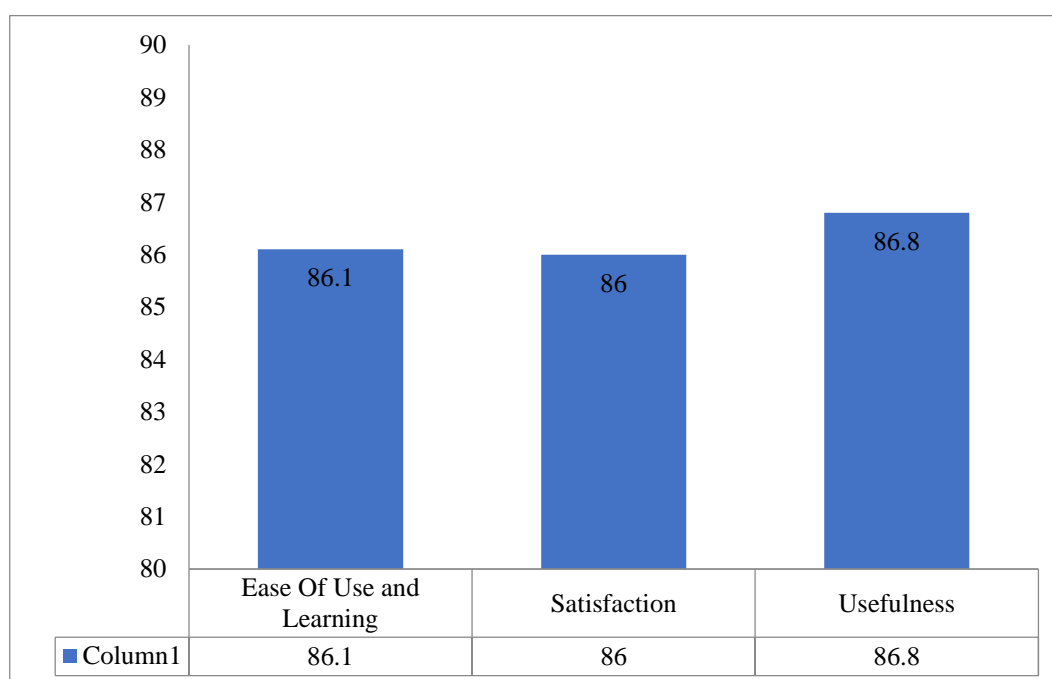
Item	Score (%)
1. <i>Dietducate</i> helps nutrition counseling with certified nutritionists	87.6
2. <i>Dietducate</i> is useful for me	90.5
3. <i>Dietducate</i> can provide good control in my everyday life	88.4
4. <i>Dietducate</i> can save my time	86.5
5. <i>Dietducate</i> fullfils my needs	85.1
6. <i>Dietducate</i> items in accordance with my expectations	83.2

**Table 3.** Satisfaction questionnaire score

Satisfaction	Skor (%)
1. I am satisfied with <i>Dietducate</i>	84.1
2. I will recommend <i>Dietducate</i> to my friends	86.7
3. <i>Dietducate</i> is fun to use	87.8
4. <i>Dietducate</i> works the way I want it to	84.6
5. <i>Dietducate</i> is pleasant to use	85.7
6. I feel I need to have <i>Dietducate</i> apps	87.6

**Table 4. Score of Ease of Use and Learning**

<i>Ease of use and learning</i>	<b>Score (%)</b>
1. <i>Dietducate</i> is easy to use	88.9
2. <i>Dietducate</i> is practical to use	88.9
3. <i>Dietducate</i> requires simple steps for its use	88.4
4. I can use <i>Dietducate</i> without written instructions	83.5
5. <i>Dietducate</i> is consistent in providing information	86.2
6. First and routine users will like <i>Dietducate</i>	84.3
7. I can use <i>Dietducate</i> any time smoothly	82.7
8. I learn to use <i>Dietducate</i> quickly.	87.6
9. I can easily remember how to use <i>Dietducate</i>	86.5
10. I am easily skillfull at using <i>Dietducate</i>	84.9



**Figure 4.** Mean score of *Dietducate* applications based on usefulness, satisfaction and ease of use criteria