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Development of Self-Dietary Assessment Application "Diary NutriMe" as a Nutrition Assistance Tool for Overweight and Obese Adolescents

Pengembangan Aplikasi Self-Dietary Asessment "Diary NutriMe" sebagai Media Pendampingan Gizi bagi Remaja Overweight dan Obesitas

Nila Reswari Haryana[1]*, Cinta Maulida Azbi[1], Yatty Destani Sandy[1], Hardi Firmansyah[1], Risti Rosmiati[1]

[1]Nutrition Study Program, Faculty of Engineering, Universitas Negeri Medan, North Sumatra, Indonesia

ABSTRACT

Background: Inadequate nutritional intake is often influenced by lack of knowledge among adolescents regarding the quantity and types of food they should consume, impacting their nutritional status. With technology being an integral part of modern life, it can be leveraged to improve adolescents' dietary practices by enhancing their knowledge of balanced nutrition.

Objectives: To develop the self-dietary assessment application, Diary NutriMe, as a nutritional assistance tool for overweight adolescents to improve their nutritional knowledge and dietary intake.

Methods: This study employed the Rapid Application Development (RAD) method. The feasibility assessment of the Diary NutriMe application was conducted by material and media experts using a checklist questionnaire with a Likert scale ranging from 1 (poor) to 5 (excellent), categorized into five levels: highly feasible to not feasible. The implementation involved improving nutritional knowledge among 36 overweight/obese adolescent students.

Results: The application features included a login system, nutritional status calculation, nutrient requirement estimation, food intake records, physical activity logs, a collection of nutrition education materials, and a chat feature. The material feasibility assessment received an average score of 90.7%, categorized as highly feasible, while the media feasibility assessment received an average score of 86.7%, also categorized as highly feasible. Statistical analysis using a T-test indicated no significant difference in respondents' knowledge (p-value=0.51). However, there was an increase in the average nutritional knowledge score by 7.7 points before and after using the Diary NutriMe application.

Conclusions: The Diary NutriMe application is highly feasible as a nutritional assistance tool for adolescents with overweight conditions.

INTRODUCTION

Adolescence is a transitional stage from childhood to adulthood. This age group experiences rapid growth in physical, cognitive, and psychosocial aspects. The growth includes increases in muscle mass, fat tissue, and hormonal changes, all of which affect the nutritional needs of adolescents[1]. Common nutritional problems in adolescents include undernutrition and overnutrition. However, adolescents aged 15-19 years are more likely to experience overnutrition, particularly obesity[2].

According to the 2023 Indonesian Health Survey, the prevalence of adolescents aged 16-18 years with severely underweight status was 1.7%, underweight 6.6%, overweight 8.8%, and obese 3.3%. Although these figures show a decrease compared to 2018, the reduction was less than 1% over five years[3]. In North Sumatra Province, the prevalence of overweight among children aged 13-15 years was 12.9%, while for those aged 16-18 years, it was 10.9%. These figures are lower compared to the prevalence of overweight children in Tanjung Balai City, which reached 19.27% for ages 13-15 years and 15.29% for ages 16-18 years[4]. According to de Onis et al., these prevalence rates are considered high, exceeding the threshold of 15%. Therefore, nutritional problems among adolescents in Indonesia, particularly those related to overweight, remain a significant concern requiring solutions.

Excess weight in adolescents is a serious issue, especially if it persists into adulthood. Overweight and obesity increase the risk of degenerative diseases such as diabetes, ischemic heart disease, and cancer. These diseases are linked to 44% of diabetes cases, 23% of

ischemic heart disease cases, and 7%-41% of cancer cases[6]. Research by Dejavitte et al. also reported that 9.6% of adolescents with obesity had a 3.63 times higher risk of experiencing symptoms of metabolic syndrome[7].

The nutritional issues faced by adolescents are influenced by many factors, with lifestyle-particularly dietary habits-being one of the most significant[8]. One factor contributing to suboptimal dietary patterns is the lack of nutrition education, which leads to poor food choices. Improving nutritional knowledge to address dietary patterns can be achieved through education and direct nutritional counseling. Nutritional assistance using WhatsApp with e-booklets and e-leaflets has proven effective in increasing knowledge and influencing energy and protein intake in pregnant women with chronic energy deficiency[9].

Today's adolescents are highly connected to technology, particularly smartphones and various applications/software. Therefore, leveraging technology-based tools such as Android applications offers a promising approach to improving adolescent dietary patterns. Technology-based applications have been shown to effectively increase nutritional knowledge and help users monitor their dietary intake[10]. Such applications enable adolescents to independently evaluate and control their daily food intake, encouraging healthier eating behaviors[11]. Winaningsih et al. demonstrated that an Android-based application, Nutri Diabetic Care, improved diet compliance among diabetic patients during nutritional counseling[12]. Through personalized nutritional support and interactive features, these applications can effectively enhance adolescents' understanding of balanced nutrition and support them in making better dietary decisions. With the development of the self-dietary assessment application called "Diary NutriMe," overweight adolescents can access structured nutritional support more conveniently, ultimately helping reduce the prevalence of obesity among adolescents. Based on these considerations, it is necessary to design an Android-based nutrition application as a tool to assist adolescents in managing their dietary patterns more effectively.

METHODS

The application development was carried out from April to May, 2024 using the Rapid Application Development (RAD) method. This method is a software development approach to produce high-quality applications within a shorter timeframe[13,14]. The RAD method facilitates a better understanding of system requirements through a component-based construction approach[15].

The RAD method consists of three phases involving designers (programmers), researchers (analysts), and validators in the stages of assessment, design, and implementation[14,16]. These phases include:

1. Requirement Planning

In this phase, designers, researchers, and validators interact to identify the objectives of the application development, gathering information about the needs of the target users-adolescents with overweight conditions. The findings aim to address and prevent adolescent obesity through application development. Data collection was conducted through literature reviews, discussions with validators, and preliminary studies involving adolescents at MAN Tanjungbalai, North Sumatra Province. This phase produced a user requirements document that served as a system reference for operation.

2. RAD Design Workshop

During this phase, researchers and programmers presented and developed a visual representation of the design and workflow for the validators. This stage, akin to a workshop, was used to draft and refine the application's blueprint. System modeling tools included Firebase and Flutter.

Firebase, developed by Google in 2011 by Andrew Lee and James Tamplin, is a service that simplifies application development[17]. Meanwhile, Flutter is a toolkit/framework developed by Google to create multi-platform applications-mobile, web, and desktop-from a single code base. The Flutter's features, including an expressive and flexible user interface (UI), enable the Diary NutriMe application to have an attractive design[18].

3. Implementation

In this phase, the developed application was evaluated for feasibility through validation. Validators involved in this process included subject matter experts and media experts. Validation assessments were conducted using a checklist questionnaire with a Likert scale: Score 5 (Excellent); Score 4 (Good); Score 3 (Fair); Score 2 (Poor); Score 1 (Very Poor). The obtained data were calculated using the following formula:

$$x_i = \frac{\sum S}{S_{max}} \times 100\%$$

Note:
x-i = Feasibility Score for Each Aspect
Σs = Total Obtained Score
S_{max} = Maximum Possible Score

Based on the calculated percentage, the feasibility criteria were determined as follows (per Alfiansyah): Highly Feasible (81-100%); Feasible (61-80%); Fairly Feasible (41-60%); Not Feasible (21-40%); Very Unfeasible (0-20%)[19]. If multiple validators were involved, the average percentage score was calculated and categorized.

A small-group trial was conducted with 30 respondents at MAN Tanjungbalai to evaluate improvements in nutritional knowledge. Respondents were selected using purposive sampling with inclusion criteria: 15-17 years old, overweight or obese, owning and capable of operating Android smartphones, and willing to participate. Exclusion criteria included students with a history of hormonal diseases, those undergoing medical treatment, athletes, and those on diet programs, as these factors could bias the assessment of knowledge improvement.

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Haryana et al. | Amerta Nutrition Vol. 8 Issue 3SP (December 2024). 71-81

73

A pre-test was conducted during the introduction and orientation of the application, while the post-test was administered 8 days later. During this period, respondents were reminded via WhatsApp group to read the articles within the application. The articles covered: 1) Definitions and differences between obesity and overweight; 2) Methods for determining nutritional status; 3) Obesity and overweight categories; 4) Causes of overweight and obesity (dietary patterns, physical activity, and genetics); 5) Dangers of overweight and obesity; 6) Solutions to overweight and obesity; 7) The four pillars of balanced nutrition; and 8) Examples of low-energy diet menus. The knowledge scores were statistically analyzed using a paired t-test to assess the differences before and after using the Diary NutriMe application.

This study received ethical approval from the Research Ethics Committee of the Faculty of Medicine, Maranatha Christian University. Ethical clearance was granted with Decision Letter No: 127/KEP/V/2023, issued on May 31, 2024.

RESULTS AND DISCUSSIONS
Requirements Planning

The development of the smartphone application in this study resulted in a product named "Diary NutriMe". This application is designed for all Android smartphone users, particularly adolescents with overweight and obesity status. The application serves as a control tool to assist adolescents in monitoring their dietary intake, aiming to reduce energy and fat consumption. The ultimate goal is to optimize their nutritional status over time. The preliminary study and discussions between researchers and validators identified several requirements to be fulfilled, as outlined in Table 1.

Table 1. Identified Requirements in the Requirements Planning Phase

Source	Identification
Adolescents (User)	- 12.03% were overweight.
	- 8.29% were obese.
	- Adolescents at MAN Tanjungbalai prefer fried snacks, instant noodles/cup noodles, and meatballs.
	- 10% had low nutritional knowledge, and 25% had moderate knowledge regarding balanced nutrition, obesity, and healthy food choices.
Researchers (Analyzer)	- Adolescents should independently determine their nutritional status.
	- Adolescents should understand their daily energy and macronutrient needs.
	- Adolescents should track their daily energy and macronutrient intake.
	- Adolescents should enhance their knowledge about overweight issues, principles of balanced nutrition, and strategies for preventing and managing overweight.
Validators (Approval)	- Adolescents should be able to ask questions and discuss dietary intake, physical activities, and healthy food choices with researchers/nutritionists through a chat feature.
	- Adolescents need to log their physical activities as part of preventing and addressing overweight issues.

RAD Design Workshop
1. Flow Diagrams

During this phase, researchers and programmers collaborated to design the Diary NutriMe application. The system was developed using various flow diagrams, each with specific functions to describe the system. Figure 1 illustrates the programming flow diagrams for different features of the application. Section 1: The flow diagram for the "Calculate Nutritional Status" menu. This feature allows users to determine their nutritional status based on their Body Mass Index for Age (BMI/A), targeting adolescents up to 18 years old. Section 2: The flow diagram for the "Calculate Nutritional Needs" menu. This feature enables users to calculate their daily requirements for energy, fat, protein, and carbohydrates based on weight, height, age, gender, and physical activity. Section 3: The flow diagram for the "Food

Logging" feature. This core functionality helps users record food, beverages, and snacks consumed over 24 hours daily. This feature aims to guide users in controlling excessive energy and fat intake. Users can input consumed food items, allowing them to evaluate whether their intake aligns with their energy and fat needs. The nutritional database in this feature is sourced from the TKPI 2017. Section 4: The flow diagram for the "Physical Activity Logging" feature. This provides users with a platform to log their daily physical activities, ensuring adequate physical engagement each day. Additional flow diagrams were developed for the Chat and Article features. The Chat feature allows users to communicate with the application administrator (the researcher) for both technical and health-related inquiries. The Article feature provides users access to information on nutrition, food, and health, which can be updated or revised

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p-ISSN: 2580-9776 (Print)
Haryana et al. | Amerta Nutrition Vol. 8 Issue 3SP (December 2024). 71-81

74

by researchers as needed.

2. Interface Design Development

The interface design development stage involves creating the layout for the Diary NutriMe application. The Home layout includes seven menus: Calculate Nutritional Status, Calculate Nutritional Needs, Food Records, Activity Records, Articles, Chat, and Profile. These menus are linked to their respective layouts, which users can access by selecting them. The first layout is "Calculate Nutritional Status", which contains input fields for Height (meters), Weight (kg), and Age. Users can manually enter this information. They then press the Gender button to select their gender (Male or Female) and click the Calculate Nutritional Status button to view their nutritional status. The next layout is "Calculate Nutritional Needs", which includes input fields for Height (meters), Weight (kg), and Age. Users manually enter this data and press the Gender button to select their gender (Male or Female). Additionally, users select their Physical Activity Level (Very Light, Light, Moderate, or Heavy). The final step is clicking the Calculate Nutritional Needs button to display the calculated nutritional requirements, including energy, protein, fat, and carbohydrates.

The Food Records layout is divided into two views. First View: Displays a list of food entries previously logged by the user. Users can press the (+) icon to add new food records. After inputting a record, the name of the food, its nutritional content, as well as the date and time of entry, will appear. Second View: Dedicated to inputting food records. Users can select the type of food, food name, and portion size according to their preference. After filling out the details, users click Add if the data is correct or Cancel if there is an error. Finally, users press Save Data to store the entered information.

Similarly, the Activity Records layout is also divided into two views. First View: Displays a list of activity entries previously logged by the user. Users can press the (+) icon to add new activity records. Once entered, the name of the activity and its duration will appear along with the date and time of entry. Second View: Dedicated to inputting activity records. Users select the type of activity performed and manually enter the activity duration (in minutes). After inputting the details, users click Add if the data is correct or Cancel if there is an error. Finally, users press Save Data to store the entered information.

In the Articles menu layout, users can directly view articles attached to the Diary NutriMe application upon opening the menu. These articles provide valuable information to enhance adolescents' knowledge when using the application. The Chat menu layout consists of two buttons: Button 1: Used to send photos or images. ▷ Button: Used to send messages. This comprehensive layout design ensures the application is user-friendly and serves its purpose effectively.
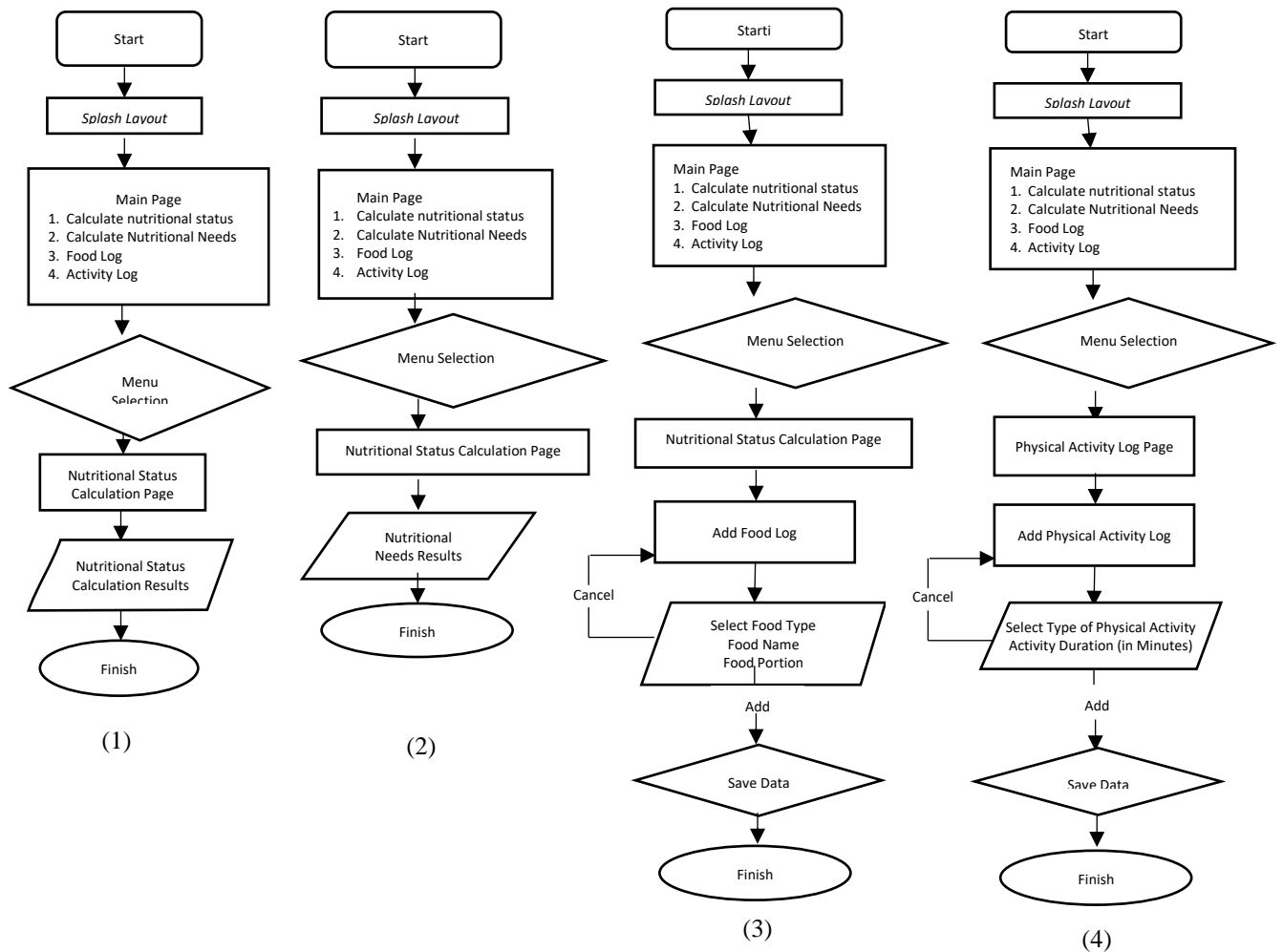
Figure 1. Flowchart of Feature Programming in *Diary NutriMe*

3. Implementation Application Form of Diary NutriMe
    Following the RAD Design Workshop phase, the next step is implementation. In this phase, the flowchart and layout design from the previous stage are implemented into an Android-based application. The implementation results for the Home page and the features Calculate Nutritional Status and Calculate Nutritional Needs in the Diary NutriMe application are shown in Figure 2.
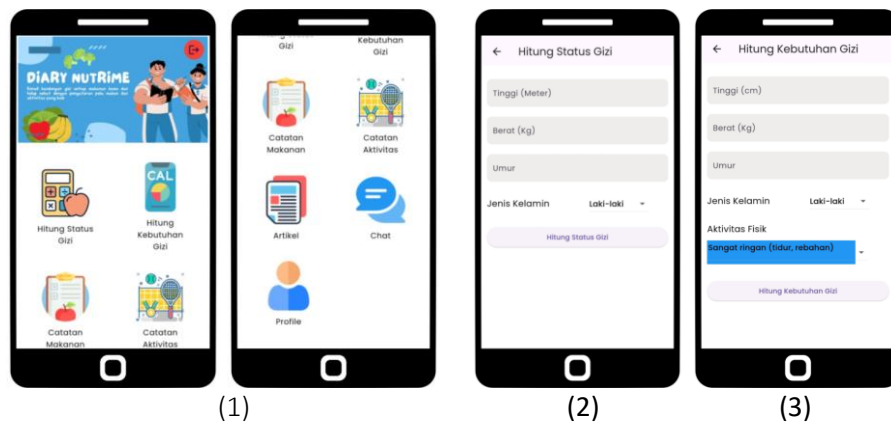
Figure 2. Display of Home Page, Nutritional Status, and Nutritional Needs

Section (1) in Figure 2 shows the home layout of the Diary NutriMe application, featuring an illustration of the Diary NutriMe at the top and displaying seven application menus: Calculate Nutritional Status, Calculate Nutritional Needs, Food Records, Activity Records, Articles, Chat, and Profile. Section (2) illustrates the Calculate Nutritional Status menu, where users are directed to input their height (in meters), weight (in

kilograms), age, and gender. Once the data is entered, users press the Calculate Nutritional Status button, which will display the z-score value and a description of their nutritional status. To return to the Home menu, users can press the (←) button at the top left corner. Section (3) depicts the Calculate Nutritional Needs menu, where users are prompted to input their height, weight, age,

gender, and physical activity level. After entering the data, users press the Calculate Nutritional Needs button, which will display the nutritional requirements, including energy, fat, protein, and carbohydrates. To return to the Home menu, users can press the (←) button at the top left corner.

Figure 3. Display of Food Records and Physical Activity Records

Figure 3 shows the features Food Records (Section 1) and Physical Activity Records (Section 2). To add a food record in the Food Records menu, users can click the (+) button located at the bottom right corner upon entering the menu for the first time. Users are then directed to select food options provided in the Diary NutriMe application and specify portion sizes. After selecting the food items and portions, users can press the Add button if the data is correct. Once completed, users can view the newly added food entry on the menu display. Users can press the Save Data button to save the food record. The food data is stored along with the date and time when the record was added. To return to the

Home menu, users can press the (←) button.

Adding an activity record in the Physical Activity Records menu follows a similar process to adding food records. Users click the (+) button at the bottom right corner upon first entering the menu. They are directed to select activities from the provided options and manually input the activity duration in minutes. Users then press the Add button if the data is correct. The newly added activity is displayed on the menu, and users can press the Save Data button to save the activity record. The activity data is stored along with the date and time when the record was added. To return to the Home menu, users can press the (←) button.
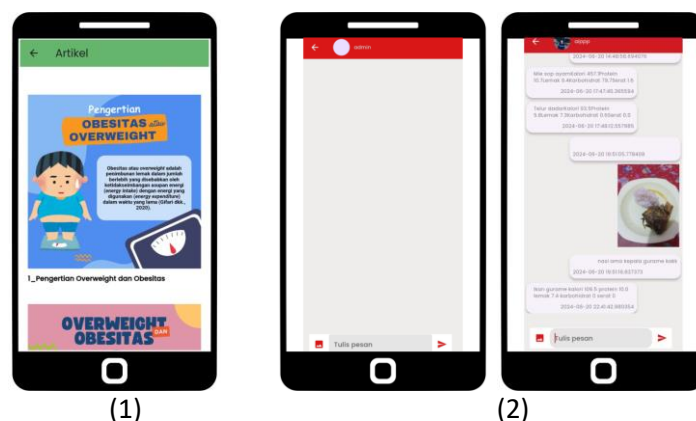

Figure 4. Display of Articles and Chat Features

Figure 4 consists of two sections: the Article display (Section 1) and the Chat feature display (Section 2). In the Article menu, users are presented with various articles available in the Diary NutriMe application. Users can scroll through the articles to access more information

about overweight or obesity. To return to the Home menu, users can press the (←) button. For a chat session with the admin, users can open the Chat menu and type a message in the provided text box. Users can send photos by clicking the ▷ button on the left and send text

messages by clicking the ▷ button on the right.

Results of Media and Material Validation

Before being made available to users, the Diary NutriMe application underwent validation by media and material experts. Media validation was conducted to determine whether the developed media was suitable for use by respondents. The Android application design of Diary NutriMe was assessed by competent individuals (validators) specializing in media technology. The aspects evaluated by media experts included overall display, text layout, application operation, application effectiveness, and language.

Table 2. Results of Media Expert Validation on the Feasibility of the Diary NutriMe Application

Evaluation Criteria	Score
Overall Display	22
Text Layout	13
Application Operation	17
Application Effectiveness	16
Language	10
Total Score	**78**
Maximum Score	**90**
Feasibility Percentage	**86.6%**
Criteria	**Highly Feasible**

Table 2 presents the evaluation results conducted by media expert validators using a media expert questionnaire. The total media validation score was 78. When converted into a percentage based on the maximum score of 90, the media feasibility score was 86.6%, classified as highly feasible without requiring revisions. Material validation was carried out to assess the relevance and accuracy of the content within the Diary NutriMe application, tailored to the needs of adolescent respondents aged 14-18 years experiencing overweight or obesity. The material validators were experts in nutritional education related to overweight and obesity topics. Two validators provided independent assessments. Based on the validation results, several improvements to the article content were recommended. Updates to references or information sources were necessary to align with the latest data and research. Additionally, the menu layouts should not be presented as screenshots to ensure quality and clarity. For tables addressing overweight and obesity categories, it was suggested to use distinct or bold colors to differentiate these categories, making it easier for readers to identify the differences. In the physical activity section, the inclusion of examples and images of sedentary activities was recommended to enhance comprehension. Finally, in the section discussing genetic factors as causes of overweight and obesity, more detailed explanations were required to elucidate how genetics influence these conditions, providing readers with a more comprehensive understanding. The validation results are detailed in Table 3.

Table 3. Results of Material Expert Validation on the Feasibility of the Diary NutriMe Application

Evaluation Criteria	Validator 1 Score	Validator 2 Score
Material Relevance	17	17
Material Content	28	28
Material Presentation	18	18
Total Score	**73**	**63**
Maximum Score	**75**	**75**
Feasibility Percentage	**97.3%**	**84%**
Criteria	**Highly Feasible**	**Highly Feasible**

The development of the Diary NutriMe self-dietary assessment application for overweight teenagers represents a vital intervention in addressing obesity in this demographic. The validation results, covering both media and material, demonstrate its feasibility and effectiveness for teenagers with excess body weight. The integration of technology into dietary assessment has been a focus of recent research. Mobile applications are proven to enhance self-monitoring of food intake, crucial for effective weight management. Research by Lee et al. indicated that accurate dietary assessment through mobile applications significantly improves eating habits compared to traditional methods, such as food frequency questionnaires, which often suffer from memory bias and

respondent burden[20]. These findings align with Wong et al., who noted that varied adherence to dietary interventions is a common challenge among teenagers, necessitating tools that promote autonomy and engagement in dietary management[21]. The Diary NutriMe application addresses these challenges by providing an easy-to-use platform that encourages consistent dietary monitoring and continuous education.

Moreover, validation of this application aligns with studies emphasizing the importance of tailored dietary interventions for teenagers. For instance, Reed et al. highlighted the need to incorporate community and social factors into dietary interventions, critical for effectively engaging teenagers[22]. This approach is reflected in the design of the Diary NutriMe application, which considers the unique social context of teenagers, thereby improving its acceptance and usability. Additionally, the application's design incorporates behavioral change principles essential for enhancing adherence to dietary recommendations[23].

The validation results confirm that the Diary NutriMe application is not only valid but also feasible for use by overweight teenagers. This aligns with findings by Cai, emphasizing that increasing dietary knowledge among teenagers is crucial for promoting healthy eating habits and reducing obesity risk[24]. The application includes educational components that enhance users' understanding of nutrition, empowering them to make informed dietary choices. Furthermore, research by Sögüt supports the notion that higher levels of dietary knowledge and self-efficacy correlate with better dietary behavior among overweight teenagers[25].

Small-Group Trial

The application was tested in a small group consisting of 31 high school students classified as overweight or obese. The trial aimed to evaluate the effectiveness of the Diary NutriMe application in improving nutritional and health knowledge within the group. Table 4 presents the trial results, which indicate a tendency for knowledge scores to increase despite no statistically significant difference between pre-test and post-test scores (p-value>0.05).

Table 4. Results of the Diary NutriMe Trial on Nutritional Knowledge Among Respondents from MAN 1 Tanjung Balai

Knowledge Level	Pre-Test		Post-Test	
	n	%	n	%
Low (<60)	7	22,6	4	12,9
Adequate (60-80)	22	71,0	17	54,8
Good (>80)	2	6,5	10	32,3
Mean ± SD	**66.5 ± 13.1**		**74.2 ± 17.9**	
Mean Difference		**7.7**		
p-value		**0.056**		

Based on the mean difference between pre-test and post-test scores, there was an increase of 7.7 points in knowledge scores. Additionally, the number of students categorized with good knowledge levels increased by 8 (25.8%), while the number of students with low knowledge levels decreased by 5 (9.7%). Knowledge categories are based on Khomsan's criteria, which classifies knowledge levels into three categories: low (<60), adequate (60-80), and good (>80)[26].

The small-group trial of the Diary NutriMe application provided valuable insights into its potential to enhance nutritional knowledge and health awareness among adolescents. This application is a vital tool for promoting healthier eating behaviors, particularly among overweight adolescents at risk of various health complications. Furthermore, the validation process involved initial testing to ensure reliability and effectiveness in real-world settings. The methodology employed aligns with best practices in intervention research, as outlined by Pbert et al., who emphasized the importance of pilot trials to assess feasibility and effectiveness[23]. The results from this validation process indicate that the application effectively meets the needs of overweight adolescents, offering a practical, accessible, and engaging dietary management tool.

The trial results showed an improvement in nutritional knowledge scores among the participants, consistent with findings from Hamułka et al., who reported that structured education programs significantly enhance nutritional knowledge, attitudes toward nutrients, and overall diet quality in adolescents[27]. Such improvements are crucial as adolescents with higher nutritional knowledge are less likely to be overweight or obese, as demonstrated by Cai (2023), who identified a correlation between nutritional knowledge and body mass index (BMI) in adolescents[24]. The Diary NutriMe application effectively integrates educational components that not only provide information on healthy eating patterns but also empower users to make informed dietary choices.

Alzaben et al. highlighted that nutrition education interventions delivered through applications can significantly improve dietary practices, with interactive features and user-friendly interfaces contributing to sustained engagement and behavioral change[28]. Respondents in the trial reported increased awareness of their food intake and better understanding of the nutritional value of their meals. This aligns with findings by Szczepańska et al., who emphasized the effectiveness of educational interventions in improving nutritional knowledge among school-aged children[29]. This evidence suggests that the Diary NutriMe application not only

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Haryana et al. | Amerta Nutrition Vol. 8 Issue 3SP (December 2024). 71-81

79

educates but also motivates adolescents to adopt healthier eating habits.

The positive outcomes of the trial also underscore the importance of integrating technology into health education strategies. Fayasari noted that leveraging technology significantly enhances the delivery of nutritional knowledge and raises awareness of healthy lifestyles[30]. The Diary NutriMe application exemplifies this integration by utilizing a platform easily accessible to adolescents, thereby increasing the likelihood of sustained engagement and usage. This technological approach is critical in the digital age, where adolescents increasingly rely on mobile devices for information and social interaction.

The development of this application stands out as it specifically targets overweight adolescents under the age of 19. The application includes various materials designed to motivate adolescents to lose weight and provides guidance on selecting healthy foods. Additionally, the chatting feature allows adolescents to interact directly with researchers for personalized consultation on daily food and snack choices, aiding in the personalized implementation of weight-loss strategies. However, a key limitation of this study was the media validation process, which involved only one expert validator due to the limited availability of experienced validators. This may have affected the accuracy of the application's feasibility assessment. Therefore, future development of the application should expand its scope to include adolescents with normal, underweight, and overweight nutritional statuses. Media validation should also involve more than one experienced validator, particularly those specializing in nutrition and health.

A notable advantage of this study is the creation of an application that adolescents can use to monitor their daily food intake. Furthermore, the application is highly appealing in terms of its design and practical usability. However, the application is not yet integrated into the Play Store, limiting its accessibility and distribution. Future development plans include enabling the application to calculate calories burned through physical activities or daily steps, further enhancing its functionality.

CONCLUSIONS

The Diary NutriMe application was developed as a nutritional companion tool for overweight adolescents to enhance their knowledge and improve their nutritional intake, ultimately contributing to better nutritional status in the long term. The development process utilized the Rapid Application Development (RAD) method and resulted in various features such as nutritional status calculation, nutritional needs estimation, food diary, physical activity log, educational nutrition materials (articles), and a chat feature. The feasibility test results indicated that the application was rated as highly feasible by material experts and media experts. Furthermore, there was an observed improvement in adolescents' nutritional knowledge after using the application, as evidenced by the average score difference and an increase in the number of users with good knowledge levels.

AUTHOR CONTRIBUTIONS

NRH: conceptualization, data curation, formal analysis, funding acquisition, investigation, supervision, roles/writing-original draft, writing-review & editing; CMA: conceptualization, data curation, methodology, project administration, resources, software; YDS: conceptualization, investigation, validation, visualization; HF: validation, data curation, supervision; RR: conceptualization, formal analysis, writing-review & editing.

REFERENCES

1. Fitria, I. Gizi Remaja. in *Remaja* (eds. Hardinsyah, H. & Supariasa, I.) 10-43 (Pernerbit Buku Kedokteran EGC, 2006).

2. Pertiwi, Y. & Niara, S. I. Pencegahan obesitas pada remaja melalui intervensi promosi kesehatan: studi literatur. *Jurnal Ilmu Kesehatan Masyarakat* **14**, 96-104 (2022): https://doi.org/10.52022/jikm.v14i2.278

3. Kemenkes, K. K. R. *Survei Kesehatan Indonesia 2023 : Dalam Angka*. (2024).

4. Badan Penelitian dan Pengembangan Kesehatan. *Laporan Provinsi Sumatera Utara Riskesdas 2018*. (2018).

5. De Onis, M. *et al.* Prevalence thresholds for wasting, overweight and stunting in children under 5 years. *Public health Nutrition* **22**, 175-179 (2019): https://doi.org/10.1017/S1368980018002434

6. Direktorat Pencegahan dan Pengendalian Penyakit Tidak Menular. *Panduan Pelaksanaan Gerakan Nusantara Tekan Angka Obesitas (Gentas)*. (2017).

7. Dejavitte, R. A. S., Enes, C. C. & Nucci, L. B. Prevalence of metabolic syndrome and its associated factors in overweight and obese adolescents. J*ournal of pediatric endocrinology and metabolism* **33**, 233-239 (2020): https://doi.org/10.1515/jpem-2019-0369

8. Az-zahra, K. & Ratih Kurniasari. Implikasi

Nutrition

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p-ISSN: 2580-9776 (Print)
Haryana et al. | Amerta Nutrition Vol. 8 Issue 3SP (December 2024). 71-81

80

konseling gizi terhadap pemilihan makan pada remaja obesitas: literature review. *Media publikasi promosi kesehatan Indonesia* **5**, 757-762 (2022): https://doi.org/10.56338/mppki.v5i7.2273.

9. Anggi Dwi Yanti, I Nengah Tanu Komalyna & Tapriadi. Perbedaan tingkat pengetahuan gizi, tingkat konsumsi energi dan protein antara pendampingan berbasis whatsapp dengan media e-booklet dan e-leaflet pada ibu hamil kurang energi kronis (KEK) di Wilayah Kerja Puskesmas Arjowinangun Kota Malang. *Media publikasi promosi kesehatan Indonesia* **5**, 1363-1371 (2022): https://doi.org/10.56338/mppki.v5i11.2737.

10. Hingle, M. & Patrick, H. There are thousands of apps for that: navigating mobile technology for nutrition education and behavior. *Journal of nutrition education and behavior* **48**, 213-218.e1 (2016): https://doi.org/10.1016/j.jneb.2015.12.009

11. Wang, Y. *et al.* Childhood obesity prevention programs: comparative effectiveness review and meta-analysis. Rockville (MD): Agency for Healthcare Research and Quality. AHRQ Comparative Effectiveness Reviews No 115 (2013) (Diakses 26 Oktober 2024)

12. Winaningsih, W., Setyowati, S. & Lestari, N. T. Aplikasi nutri diabetic care sebagai media konseling untuk meningkatkan kepatuhan diet diabetes mellitus. *Ilmu gizi Indonesia.* **3**, 103 (2020): https://doi.org/10.35842/ilgi.v3i2.134

13. Gibran, G. & Wahanggara, V. Implementasi Rapid Application Development (RAD) Model Pada Pengembangan Aplikasi Rent Car Berbasis Android. *Skripsi tidak diterbitkan. Jember PPs Univ. Muhammadiyah Jember* (2018).

14. Romadona, S. & Afifah, C. A. N. Pengembangan aplikasi sehatgram berbasis smartphone dalam mengatasi dan mencegah obesitas pada remaja. Jurnal gizi Universitas Negeri Surabaya. **2**(3), 155-163 (2022). Diakses 24 Oktober 2024: https://ejournal.unesa.ac.id/index.php/GIZIUNESA/article/view/50257

15. Aluano, B., Sambul, A. M. & Rindengan, Y. D. Y. Aplikasi pemenuhan gizi melalui pola makan pada penderita tuber kolosis paru berbasis android. *Jurnal teknologi informasi* **12**, (2017): https://doi.org/10.35793/jti.12.1.2017.17853

16. Kendall, K. E. & Kendall, J. E. *Analisis dan Perancangan sistem*. Edisi Bahasa Indonesia. Jakarta: PT Prenhallindo (2018).

17. Purnomo, P. O. . & Aziz. *Membangun Aplikasi Berbasis Android*. Jakarta: Penerbit Andi (2020).

18. Suryono, S. & Hardinsyah, H. *Panduan Lengkap*

Membuat Aplikasi Android & iOS dari Nol Menggunakan Flutter. (PT. Lauwba Techno Indonesia, 2020).

19. Alfiansyah, K. Pengembangan aplikasi smartphone KJPAI berbasis android menggunakan appyet untuk menunjang sistem informasi jurusan pendidikan agama Islam. [Doctoral dissertation, UIN Raden Intan Lampung] (2019).

20. Lee, J., Song, S., Ahn, J., Kim, C. & Lee, J. E. Use of a mobile application for self-monitoring dietary intake: feasibility test and an intervention study. *Nutrients* **9**, (2017): https://doi.org/10.3390/nu9070748.

21. W Wong, J. M. *et al.* A randomized pilot study of dietary treatments for polycystic ovary syndrome in adolescents. *Pediatric obesity* **11**(3), 210-220, (2015): https://doi.org/10.1111/ijpo.12047.

22. Reed, M. *et al.* Development and feasibility of an obesity prevention intervention for adolescent African American daughters and their mothers. *Journal of healthy eating and active living* **1**(1), 94-107 (2021): https://doi.org/10.51250/jheal.v1i2.14.

23. Pbert, L., Wang, M. L., Druker, S., Jackson, E. A. & Rosal, M. C. Designing and testing the feasibility of a multi-level intervention to treat adolescent obesity in the pediatric primary care setting. *Journal of child and adolescent behavior* **3**(2). (2015): https://doi.org/10.4172/2375-4494.1000196.

24. Cai, Z. Influence of adolescents' and parental dietary knowledge on adolescents' body mass index (BMI), overweight/obesity in 2004-2015: a longitudinal study. *Archives of public health* **81**(1), 188, (2023): https://doi.org/10.1186/s13690-023-01197-x.

25. Sögüt, S. Determining the differences in nutrition knowledge, dietary behaviors, physical activity and self-efficacy behaviors based on obesity status among adolescents. *Journal of human sciences* **15**(2), 747-754, (2018): https://doi.org/10.14687/jhs.v15i2.5218.

26. Khomsan, A. *Teknik Pengetahuan Gizi*. *IPB Press* (2021).

27. Hamułka, J., Wądołowska, L., Hoffmann, M., Kowalkowska, J. & Gutkowska, K. Effect of an education program on nutrition knowledge, attitudes toward nutrition, diet quality, lifestyle, and body composition in polish teenagers. The ABC of healthy eating project: design, protocol, and methodology. *Nutrients*, **10**(10), 1439, (2018): https://doi.org/10.3390/nu10101439.

28. Alzaben, A. S., Alnashwan, N. I., Alatr, A. A., Alneghamshi, N. A. & Alhashem, A. Effectiveness

of a nutrition education and intervention programme on nutrition knowledge and dietary practice among Princess Nourah Bint Abdulrahman University's population. *Public Health Nutrition* **24**(7), 1854-1860, (2021): https://doi.org/10.1017/s1368980021000604.

29. Szczepańska, E. *et al.* The Project "colourful means healthy" as an educational measure for the prevention of diet-related diseases: investigating the impact of nutrition education for school-aged children on their nutritional knowledge. *International journal of environmental research and public health* **19**(20), 13307, (2022): https://doi.org/10.3390/ijerph192013307.

30. Fayasari, A. Effect of UNAGI (nutrition snakes and ladders game) on knowledge of balanced diet and nutritional intake in adolescents in Bekasi. *Indonesian journal of human nutrition* **10**(2), (2023): https://doi.org/10.21776/ub.ijhn.2023.010.02.5.