ABDIMAS: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang
Vol.9(1) February 2024, 31-41
p-ISSN: 2721-138X e-ISSN: 2548-7159
http://jurnal.unmer.ac.id/index.php/jpkm

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Assistance process blood cockle (Anadara granosa) based meatballs as local food to prevent anemia in adolescent girls

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ARTICLE INFO:

Received: 2023-11-30
Revised: 2024-01-04
Accepted: 2024-02-12
Published: 2024-02-29

Keywords:

Anemia, Anadara granosa, Blood cockle, Innovation, Meatballs

ABSTRACT

Assistance in processing local food based on blood cockle (Anadara granosa) can support the anemia prevention program for young women towards a stunting-free Gorontalo. The number of participants included was 20, it's made up of two craft teachers and two school managers. The participants came from SMAN 1 Tilango, SMAN 1 Batudaa Pantai, SMAN 1 Biluhu, SMAN 1 Dungaliyo, and SMAN 1 Pulubala. It involves 5 students from Gorontalo State University who participated in the MBKM research program. The purpose of this activity is for teachers and school canteen operators to gain knowledge about the processing of blood cockle meatballs and use them as potential for the development of local food products to prevent anemia in young women. The importance of innovation in local food processing, such as introducing new technology and developing healthier and more sustainable products. Activities are carried out using five methods, namely lecture, question-and-answer, discussion, practice, and evaluation methods. The result of this service activity was that the participants received the training material and received a positive response. Most participants stated that this activity helped them to innovate and develop their businesses in terms of diversifying local food processing.

How to cite: Zainuddin, A., Solang, M., Retnowati, Y., Kumaji, S. S., Akbar, N., Saman, W. R., Santoso, B., Solikahan, E. Z., & Rahim, E. (2024). Assistance process blood cockle (Anadara granosa) based meatballs as local food to prevent anemia in young women. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 9*(1), 31-41. https://doi.org/10.26905/abdimas.v9i1.11752

1. INTRODUCTION

The prevalence of stunting in Gorontalo in 2021 was 29.0%, and in 2022, there was a decrease of 5.2%, resulting in a prevalence of 23.8%. In 2024, the Indonesian government set a target prevalence of stunting at 14%. This indicates that the Gorontalo Province still needs to make efforts to reduce stunting

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by 9.8% to achieve the national target for stunting prevalence in 2024. The highest prevalence of stunting in Gorontalo, based on the Indonesian Nutritional Status Survey, was in Gorontalo Regency (30.8%), exceeding the prevalence in the Gorontalo Province (23.8%) (Badan Kebijakan Pembangunan Kesehatan, 2022). One of the causes of stunting is anemia in adolescent girls. Anemia is still among adolescent girls in Gorontalo Province indicating low coverage of TTD supplementation among adolescent girls in Gorontalo (Tim INFOKOM, 2019). Furthermore, the education provided regarding TTD is still general, mainly consisting of socialization and distribution to schools. However, observations in the field indicate that many adolescent girls do not consume TTD due to fear, nausea, and stomach pain. One solution to prevent anemia in adolescent girls is through education on the utilization of local foods rich in protein, zinc, and iron, based on Tegillarca granosa, such as meatballs (*bakso*). Local foods enhance nutritional value and can also serve as economic opportunities for local communities, especially school canteen operators.

This program partnered with five schools in Gorontalo Province, particularly in Gorontalo Regency: SMAN 1 Tilango, SMAN 1 Batudaa Pantai, SMAN 1 Biluhu, SMAN 1 Dungaliyo, and SMAN 1 Pulubala, involving 10 vocational teachers, 10 canteen operators, and 20 anemic female students. School-age children should consume foods that align with a balanced diet. One of the most popular habits among elementary school students is snacking, yet snacks consumed at school may not suffice to meet their daily nutritional needs. Hence, providing healthy food in school canteens is crucial. Lifestyle reflects how individuals manage their personal lives, interact with society, behave in public, and endeavor to distinguish themselves from others through social symbols. Adolescents are highly susceptible to anemia if their lifestyle lacks balance. A healthy lifestyle requires a balanced pattern of behavior encompassing knowledge, attitudes, and practices (Lubis et al., 2023). Nutrition education is highly effective in altering the knowledge and attitudes of adolescent girls toward food, yet less effective in changing eating practices (Blaney et al., 2015).

Based on observations of 10 vocational teachers in Gorontalo Regency, it was found that their understanding of utilizing local foods to prevent anemia within the curriculum is severely lacking. This underscores the need to enhance the skills of vocational teachers in developing lesson plans based on the utilization of local foods to prevent anemia in Gorontalo Regency. Most school canteens offer limited options such as yellow rice, fried snacks, and colored beverages. One initial effort to raise awareness of healthy canteen programs in educational institutions is through training programs for implementing healthy canteens for canteen operators. Ensuring adequate access to quality food is essential for achieving community well-being and health, particularly in addressing stunting. Gorontalo boasts potential sources of both plant-based and animal-based foods, but local foods in each regency have yet to be optimally identified, necessitating mapping the potential of local food sources (Katili et al., 2023). Healthy canteens should provide nutritious main meals and snacks that are hygienic and safe for consumption by students and other school community members. Healthy canteens help introduce students to healthy eating habits, enabling them to choose better food options for their bodies. By consuming nutritious foods, students have more energy for learning and participating in school activities.

Adolescence is a phase of life characterized by psychological exploration to find one's identity. This transitional period entails numerous changes, both biological and psychological (Budianto, 2016). Most adolescent girls perceive themselves as overweight or obese, leading to irregular eating habits. Irregular eating patterns, reduced food intake, or loss of appetite due to vomiting pose significant risks. Reduced intake of animal protein can lower hemoglobin levels in young women, leading to anemia. Adolescent girls are particularly vulnerable to anemia as they undergo menstruation, during which they require more iron to replace the blood lost during menstruation (Indrawatiningsih et al., 2021).

Insufficient red blood cell production is one of the causes of anemia. Individuals with anemia indirectly impacted by complications due to their daily lifestyle choices suffer adverse effects on their health, leading to limitations in their daily activities (Lubis et al., 2023). Anemia is a condition characterized by lower-than-normal levels of hemoglobin and red blood cells. Iron-deficiency anemia in adolescent girls poses a higher risk as it lowers their immune system, making them susceptible to health issues (Anggoro, 2020). This results in insufficient oxygen delivery to cells and tissues, impairing their function (hypoxemia). Anemia arises from inadequate red blood cell production, excessive blood loss, and rapid destruction of red blood cells. Poor iron absorption from food can lead to the body's inability to produce hemoglobin (Hb). Symptoms of anemia include fatigue, weakness, headache, dizziness, pale or yellowish skin, and cold hands and feet. Individuals with this condition often initially fail to recognize these symptoms, but they become more pronounced as anemia worsens. If left untreated, anemia can lead to fatigue, heart and lung disorders, pregnancy complications (premature birth or low birth weight), and growth and development issues in children or infants, hindering their activities and making them highly susceptible to infections. In emergency situations, the surrounding community may not be aware of the appropriate actions for victims or the signs and symptoms of the disease (Sari et al., 2023).

Limited knowledge of anemia among adolescents increases the risk of experiencing anemia by 2.3 times. This can influence their behavior, including lifestyle and eating habits. Lack of knowledge about anemia results in insufficient iron intake, leading to anemia in adolescents (Martini, 2015). Adequate education on nutrition needs to be provided to raise awareness of nutritional requirements within the community (Zainuddin, 2014). Poor nutrition is not only caused by economic poverty but also by nutritional ignorance, such as anemia, as nutritional knowledge is highly dependent on educational levels. Several previous studies have shown that factors influencing anemia include nutritional knowledge, dietary patterns, and compliance with iron supplementation. Iron sources include animal-based foods such as poultry, meat, fish, and shellfish. Research by Indartanti & Kartini (2014) indicates that nutritional status is related to the incidence of anemia in adolescent girls. The development of local foods should consider protein and micronutrient content. Local food sources are indeed needed by the target group for stunting. Inadequate iron intake and other nutrients such as vitamin A, vitamin C, folate, riboflavin, B12, and errors in iron consumption, such as consuming iron concurrently with other substances, can disrupt the iron absorption process, which is a contributing factor to the high incidence of anemia among adolescent girls (Julaecha, 2020).

One type of cockle that contains hematopoietic pigment (hemoglobin) and appears red is the blood cockle (Anadara granosa). These cockles are commonly found in the Pohuwato province and are typically prepared as skewers or cooked cockle meat. Blood cockles contain approximately 27.26% protein and various minerals, including Zinc at 81.16 ppm, Fe at 1720.46 ppm, Cu at 4.26 ppm, and Ca at 318.67 ppm (Solang et al., 2013). Blood cockles are a popular seafood among communities. Utilizing blood cockles as raw material for making meatballs provides a solution and enhances the value of the product itself (Nurwin et al., 2019). Blood cockles are also rich in iron, which is highly beneficial for health. Iron found in blood vessels forms hemoglobin, which transports oxygen in the blood throughout the body and can be used to address anemia in adolescent girls. Cockles have been developed into products such as nuggets, meatballs, crackers, and moringa leaves utilized as fortification ingredients in porridge (Solang et al., 2022).

Blood cockle meatballs are highly suitable for consumption by individuals with low blood levels as they are rich in iron, which helps rebuild lost red blood cells. Some individuals may have low Hb levels without symptoms. However, if Hb levels in the body are too low, individuals may experience symptoms such as fatigue, headaches, or shortness of breath. Anemia sufferers are caused by hemoglobin deficiency. Blood

cockle meatball products are expected to become a healthy snack alternative for adolescent girls sold in school canteens. Regarding the benefits of blood cockle meatballs, the community engagement team endeavors to process blood cockle meatballs based on local ingredients to prevent anemia in adolescent girls and provide information to school craft teachers and canteen managers about the benefits of blood cockles. Processing blood cockle meatballs and utilizing them as a potential development of local food products to prevent anemia in adolescent girls. The importance of innovation in local food processing, including the introduction of new technologies and the development of healthier and more sustainable products. Assisting canteen managers in processing local food products and implementing nutritious local food products for adolescent health in craft subjects. This community engagement program aims to enhance the knowledge and skills of partner schools, particularly in the Gorontalo province, especially in the Gorontalo district, in addressing stunting and anemia issues among female students.

2. METHODS

Activities Planning

The community service program is conducted at SMAN 1 Dungaliyo, involving 5 schools located in Gorontalo Regency, namely SMAN 1 Tilango, SMAN 1 Batudaa Pantai, SMAN 1 Biluhu, SMAN 1 Dungaliyo, and SMAN 1 Pulubala. This initiative engages 10 vocational teachers, 10 canteen operators, and 20 female students suffering from anemia.

Implementation Method

The activities in this community service program involve the socialization and asisstance on the processing of meatball products made from blood cockles to prevent anemia in adolescent girls. The service initiative commences with the dissemination of information on the processing and management of blood cockle meatball products based on local ingredients. Subsequently, the program includes hands-on guidance on the processing of blood cockle meatballs, focusing on the active involvement of vocational teachers and canteen operators in transforming blood cockles into meatball products. The tools, ingredients and procedures for processing blood cockle meatballs can be seen in Table 1.

Table 1. Procedure for Processing Blood cockles Meatballs

Tools	Materials	Processes
Stove Pan Wok Spatula Oil drain Basin Blender Vacuum sealer	Clean blood cockles (170 grams) Tuna fillet (80 grams) Meatball flour (75 grams) Tapioca flour (125 grams) Shallots (50 grams) Garlic (50 grams) Coriander (2.5 grams) Egg (1 item) Ice cubes (1 pack)	Prepare the cleaned blood cockles and tuna meat then ground. Puree the shallots and garlic then sauté. Put all the ingredients in a container with blood cockles, ground tuna, meatball flour, tapioca flour, sauteed garlic and shallots, coriander and beaten eggs. Mix by kneading by hand or using a tool until all the ingredients are completely mixed. Boil the water until it boils. Then the meatball dough is molded or shaped with one hand and pressed until the dough comes out through the index finger and thumb. Put the formed dough into boiling water. If the meatballs float, then they are cooked, then remove and drain. Continue until all the dough is used up. Next, labeling and vacuum packaging are carried out on the blood cockle meatball products.

Schedule and Stages of Implementation

This community service program is carried out through several stages as shown in Table 2.

Table 2. Stages of Implementing the Community Service Program

Schedule	Goals	Stages
September 5, 2023	Providing the initial knowledge of craft teachers and canteen operators before receiving socialization and mentoring	Completing the Pre-Test Questionnaire "Monitoring Evaluation of Local Food Processing and Management for Craft Teachers and Canteen Operators" Participants: 10 craft teachers and 10 canteen operators
September 6, 2023	Providing education to female students regarding the nutritional needs of adolescent girls	Socialization: 1. Education on Adolescent Nutritional Needs, Anemia and Stunting 2. Local food nutrition education to overcome anemia in young women Participants: 20 female students suffering from anemia
September 12, 2023	Providing education to female students regarding environmental management	Socialization: 1. Environmental Management Education for Adolescents to Overcome Stunting Participants: 20 female students suffering from anemia
September 12, 2023	Increasing knowledge among craft teachers and canteen operators regarding things that need to be considered in processing local food and food management in terms of presentation, hygiene and food safety	Socialization: 1. Local Food Processing Module 2. Local Food Management Module Participants: 10 craft teachers and 10 canteen operators
September 20, 2023	Increasing the knowledge of craft teachers and canteen operators regarding processing local food based on blood cockles into meatball products and marketing strategies and business models	Socialization: 1. Local Food Processing 2. Marketing Strategy and Business Model Participants: 10 craft teachers and 10 canteen operators
September 20, 2023	Increase the knowledge and skills of craft teachers and canteen operators in processing blood cockle meatballs	Asisstance: 1. Processing Blood cockles into Meatball Products Participants: 10 craft teachers and 10 canteen operators
September 20, 2023	Knowing the knowledge and skills of craft teachers and canteen operators after socialization and mentoring activities	Completing the Post Test Questionnaire "Monitoring Evaluation of Local Food Processing and Management for Craft Teachers and Canteen Operators" Participants: 10 craft teachers and 10 canteen operators

3. RESULTS AND DISCUSSION

The community service falls under the CEMARA E-GASING program (Preventing Anemia in Adolescents through Edudigital Local Food towards Stunting-Free Gorontalo), aligned with the goals and

objectives of Gorontalo State University's initiative to reduce stunting rates in Gorontalo Province. The service activities are conducted using five methods: lectures, question and answer sessions, discussions, training, and evaluation. The lecture method involves the oral dissemination of information and knowledge to a large group of participants, typically engaging them in a passive manner. This activity stimulates participants to pose fundamental questions at crucial points. Lectures are presented through engaging PowerPoint presentations to maintain participants' interest and avoid boredom, followed by question-and-answer sessions.

The discussion method presents case studies, with participants collaborating to solve problems or complete specific tasks, aiming to achieve predetermined learning objectives set by the moderator. This method serves as a platform for discussing class content through statements and questions addressing problematic issues, encouraging rational and objective discussions. This technique fosters critical thinking among participants, enabling them to gather opinions, draw conclusions, and develop different problem-solving alternatives. According to Wisnuwardani et al. (2023), evaluating nutrition education programs involves the active participation of female high school students and analyzing different levels of knowledge before and after interventions. All participants actively engage in the nutrition education program. Based on participants' responses, the majority are aware of anemia (86%), even though they have never attended nutrition education programs or other anemia-related socialization efforts (60%).

The activities also utilize two modules: the Local Food Processing Module and the Local Food Management Module. These modules greatly assist participants in further exploring locally available foods and raising awareness about the importance of consuming local foods. Additionally, they help teachers and canteen operators learn more about available local foods and increase awareness about the importance of introducing local foods, particularly to adolescent girls suffering from anemia, which can help reduce stunting in children.

Figure 1. Presentation of material

The community service activities conducted in the five pilot schools, particularly in Gorontalo Regency, Gorontalo Province, have enhanced the understanding of vocational teachers and canteen operators regarding the importance of macronutrients (protein) and micronutrients (zinc and iron) in improving growth nutrition and preventing anemia in adolescent girls. According to research by Solang et al. (2013), cockles contain higher zinc content (75 mg/100 g) compared to zinc content in egg whites (0.02 mg/100 g) and chicken (1 mg/100 g). Education activities focusing on utilizing local food sources rich in zinc and protein from cockles were conducted at Dungaliyo School, involving vocational teachers, canteen operators, and female students suffering from anemia. The content delivery covered education on nutritional needs for adolescent girls, lifestyle management to prevent anemia, the nutritional value of blood cockles, food safety, hygiene and sanitation, food quality assurance, blood cockle meatball processing techniques, marketing strategies, and business models. Anemia education programs in Islamic boarding schools and high schools show no significant differences because both programs can improve female students' knowledge. Consistent with community services among adolescent females in Islamic boarding schools in Purwokerto, an increase in reproductive health literacy was found after peer education (Nafisah et al., 2023).

The introduction of local food, food nutrients, primary and secondary processing, as well as the development of new products and innovations, are covered in the local food processing module, while the local food management module includes the selection of raw materials and types of packaging, hygiene and sanitation in food production, local food safety, marketing strategies, business models, and business management as shown in Figure 2. Most participants expressed that this activity significantly assisted them in innovating and developing their businesses in terms of diversifying local food products. This module proves highly beneficial in providing a closer understanding of the available local food products in their respective regions and enhancing awareness regarding the importance of consuming local food. Local food refers to food consumed or produced in accordance with local potential and wisdom. Additionally, local food can enhance added value and serve as an economic opportunity for communities, particularly for school canteen operators.

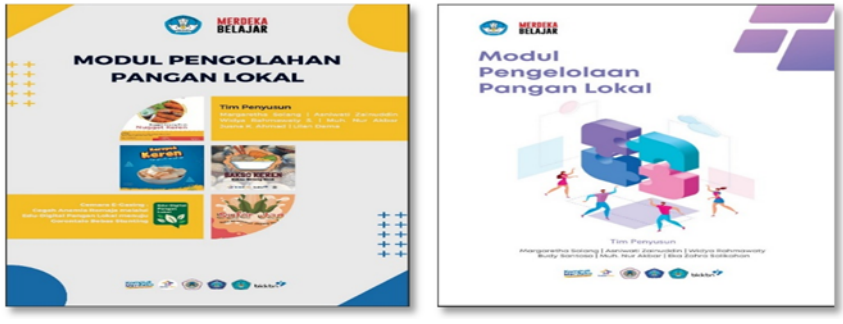

Figure 2. Learning modules

Bakso Akagai is a processed product made from blood cockle and tuna. The meat of blood cockles are sourced from cockle cultivation areas in the Pohuwato district. Blood cockles in their shells, which are shell-less cockle products that are partially cooked and ready to eat, are often processed into food, while the tuna meat is purchased from the fish auction place (*tempat pelelangan ikan*) in the city of Gorontalo. Processing red cockle meatballs can enhance the nutritional value of the food. Blood cockles contain 19.48% protein, 2.50% fat, 74.34% water, 2.24% E, and other vitamins including vitamin C. These contents

are crucial in increasing Hb levels, as protein and vitamin C play important roles in absorption, enhancing iron absorption in the body (Fitri et al., 2023). Meanwhile, the crude protein content of yellowfin tuna is 23.52%, the crude fat content of bigeye tuna is 23.72%, the crude fat content is 1.93%, 2.06%, DHA content is 16.91%, 20.22%, and the DHA content is 16.91%, 20.22%. EPA is 2.39%, 3.27% (Patty et al., 2023).

Bakso is a processed meat product that is mixed with starch and spices, with or without the addition of other food ingredients, which is shaped round or in other forms and cooked through boiling or steaming processes (Nurwin et al., 2019). The processing of blood cockle meatballs begins with mixing the blood cockles and tuna that has been ground, then combining it with other weighed additional ingredients as shown in Figure 3. The mixture is then shaped into balls. The dough that has been shaped is then soaked at a temperature of 40ºC, then the meatballs are boiled at a temperature of 80ºC, and drained until cooled (Nurwin et al., 2019).

Figure 3. Practice of processing blood cockle meatballs

An analysis is needed so that the business does not experience losses. Calculation of the BEP (Break Even Point) for meatballs is the point where income is equal to the capital spent, thus no loss or profit as shown in Table 2. One production produces 8 product packaging per day, 1 month of production: 14 x 30 days = 240 product packaging, 1 month production cost: Rp. 31,750 x 30 Days = Rp. 952,500, depreciation is calculated based on the straight-line method, profit is obtained using the formula (70% profit x cost price).

Table 2. BEP of Blood cockle meatballs

Fixed costs	**Value (Rp)**
Labor costs	600,000
Depreciation	35,664
Total	635,664
Variable costs	Value (Rp)
Total Production Costs	31,750
Total Production Costs/Unit	3,969
Total Production Costs/Month	952,500
Basic Price Per Packaging	Rp. 3,969
Selling Price Per Packaging	Rp. 6,747
Total income	Rp. 1,619,250

The formula used for calculationg the BEP Unit is Equation 1 (Eq. 1):

$$BEP\ Unit\ =\ \frac{FC}{P\ -\ VC}$$

$$BEP\ Unit\ =\ \frac{635{,}664}{6{,}747\ -\ 3{,}969} = 228.81 = 229$$

The formula used for calculationg the BEP Rupiah is Equation 2 (Eq. 2):

$$BEP\ Rupiah\ =\ \frac{FC}{1\ -\ \frac{VC}{TR}}$$

$$BEP\ Rupiah\ =\ \frac{635{,}664}{1\ -\ \frac{3{,}969}{1{,}619{,}250}} = 637{,}226$$

From the BEP production and price calculations, it is known that the break-even point for the blood cockle meatball business is achieved when the production of blood cockle meatballs is 229 units or the price of blood cockle meatballs is IDR 637,226. This means that to achieve profit, you must produce above 229 units per month or with total income above 637,226.

Figure 4. Questionnaire filling

Monitoring was conducted on the process of receiving and understanding materials, processing products, packaging, and business management. Furthermore, activities were monitored and evaluated through the distribution of pre and post-test questionnaires titled "Monitoring and Evaluation of Local Food Processing and Management for Craft Teachers and Canteen Operators". (Link - Google Drive) regarding service activities, skills, and business development in processing shellfish meat. Based on the monitoring and evaluation results, it can be concluded that the intended objectives of this community service project were achieved. The participants' understanding increased before and after the training, with the majority of participants having a knowledge level of 37% before the socialization. After the socialization and mentoring, participants had a very good level of knowledge of 94%. This was obtained from the tabulation of data from pre and post-test questionnaires "Monitoring and Evaluation of Local Food Processing and Management for Craft Teachers and Canteen Managers". Additionally, the community's skills in processing meatball products made from local blood cockles have also shown significant development.

4. CONCLUSION AND RECOMMENDATIONS

Based on the results of the community service activities that have been implemented, it can be concluded that the community service received very positive responses from the schools and canteen managers. The mentoring in processing local shellfish-based food materials supports the anemia prevention program for adolescent girls towards Gorontalo free from stunting. This program enhances the knowledge and skills of partner schools, specifically SMAN schools in Gorontalo Province, particularly in Gorontalo Regency, in addressing the issues of stunting and anemia among female students. Participants' understanding increased before and after the training, with the majority having a knowledge level of 37% before the socialization. After the socialization and mentoring, participants exhibited a significantly improved knowledge level of 94%.

This mentoring provides insights to craft teachers, canteen managers, and female students suffering from anemia to support the health program in Gorontalo Regency. However, there has been no utilization of local food in the school curriculum yet, and this dedication still focuses on processing blood cockle meatballs. Additionally, collaboration between the government, schools, and communities remains limited in efforts to prevent anemia among adolescent girls. For the next service team, it is hoped that they can provide mentoring to craft teachers to integrate local food into the school curriculum to address anemia and stunting in adolescent girls, develop blood cockle meat into products favored by anemic adolescent girls, and enhance cooperation with the government, schools, and communities in efforts to prevent anemia among adolescent girls.

ACKNOWLEDGEMENTS

With the implementation of community service activities in 2023 under contract number 124/E1/HK.02.02/2023, we express our gratitude to the Ministry of Education, Culture, Research, and Technology through the Matching Fund Program Kedaireka in 2023, the National Population and Family Planning Board (BKKBN) of Gorontalo Province, the Chairman of the Research and Community Service Institute (LPPM) of Gorontalo State University, the Chairman of the LPPM of Ichsan Gorontalo University, the Chairman of the LPPM of Bakti Nusantara Health Sciences College Gorontalo, and the Local Government of Gorontalo Regency, Gorontalo Province.

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