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Sago Sep: traditional food sources in eastern indonesia and their potential as alternative foods for athletes

Sago Sep: fuentes de alimentos tradicionales en el este de Indonesia y su potencial como alimentos alternativos para deportistas

Akhmad Kadir, Suharno, Yohana I. Reawaruw, Aisyah Ali, Miftah Fariz Prima Putra
Universitas Cenderawasih (Indonesia)

Abstract. Food sources around the world depend on the local availability in nature. In Indonesia, particularly in the eastern part, one of the naturally and locally available food sources is sago, which is processed into various traditional foods to meet the community's daily needs. Aside from fulfilling the demand for food, sago is also culturally valuable. This study examines sago processing into traditional cuisines in the southern part of Papua, Indonesia, with data collected through a survey. The results show that the indigenous Marind Anim people process sago into different traditional foods: papeda, roasted sago or sago plates, and sago sep. Sago sep is a traditional food of the Marind Anim tribe commonly found in the lowland areas of Merauke. Meanwhile, Papeda and sago plates are influenced by the migrant community consisting of the northern Papuan and Maollucan indigenous peoples. Sago Sep's types are sago sep Teta, Komabo, Nggalamo, Ebayak, Kwetahuk, and Sinoli, distinguished based on the additional constituent ingredients. The local people of Marind Anim still depend on sago to fulfill their food needs. They harvest sago growing naturally in the environment and turn it into foods such as sago sep, papeda, and sago plates. Apart from that, sago can be an alternative food source for athletes, especially in eastern Indonesia, because of its high carbohydrate and calorie content, although it needs to be combined with other foods to support athletes' energy needs.
Keywords: food security, Merauke, sago, traditional food, athlete's alternative food

Resumen. Las fuentes de alimentos en todo el mundo dependen de la disponibilidad local en la naturaleza. En Indonesia, particularmente en la parte oriental, una de las fuentes de alimentos disponibles de forma natural y local es el sagú, que se procesa en diversos alimentos tradicionales para satisfacer las necesidades diarias de la comunidad. Además de satisfacer la demanda de alimentos, el sagú también tiene valor cultural. Este estudio examina el procesamiento del sagú en las cocinas tradicionales en la parte sur de Papúa, Indonesia, con datos recopilados a través de una encuesta. Los resultados muestran que el pueblo indígena Marind Anim procesa el sagú en diferentes alimentos tradicionales: papeda, sagú asado o platos de sagú y sagú sep. El sagú sep es un alimento tradicional de la tribu Marind Anim que se encuentra comúnmente en las áreas de tierras bajas de Merauke. Mientras tanto, el papeda y los platos de sagú están influenciados por la comunidad migrante que consiste en los pueblos indígenas del norte de Papúa y Maollucan. Los tipos de sagú sep son sagú sep Teta, Komabo, Nggalamo, Ebayak, Kwetahuk y Sinoli, que se distinguen según los ingredientes adicionales que lo componen. La gente local de Marind Anim todavía depende del sagú para satisfacer sus necesidades alimentarias. Cosechan el sagú que crece de forma natural en el entorno y lo convierten en alimentos como sagú sep, papeda y platos de sagú. Aparte de eso, el sagú puede ser una fuente de alimentación alternativa para los atletas, especialmente en el este de Indonesia, debido a su alto contenido de carbohidratos y calorías, aunque debe combinarse con otros alimentos para satisfacer las necesidades energéticas de los atletas.
Palabras clave: seguridad alimentaria, Merauke, sagú, comida tradicional, alimentación alternativa para deportistas

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Akhmad Kadir
akhmaduncen@gmail.com

Introduction

Indonesia has abundant natural resources (Anggraeni et al., 2017; Nugroho et al., 2022), including potential food sources (Anggraeni et al., 2017; Dahlan et al., 2015). For example, Papua Province in eastern Indonesia has many potential food sources (Kadir et al., 2022a). One of them is sago, a Palmae plant commonly found in lowland areas with a high food source potential (Kadir et al., 2022b). The indigenous Marind Anim tribe inhabits areas along Merauke and the Asmat region. The topography of these lowland areas is swampy, suitable habitat for sago plants. Therefore, the community can easily cultivate sago as the main food source and develop sago-based traditional foods. The tribe consists of many sub-tribes, all of which practice the 'totems' as part of their customs in caring for the environment, including food sources (Kadir et al., 2022a).

These indigenous peoples of Papua have accumulated knowledge of traditional food systems for thousands of years. They apply the knowledge not only for their physical and spiritual dimensions but also for a balanced relationship with the natural environment. The benefits of such a balanced relationship include healing and protection from diseases (Sidiq et al., 2021). Traditional knowledge is community-based and collective, with dimensions ranging from traditional cultural expressions to traditional medicines. This knowledge is unique because it is shared across generations and passed down verbally from one to another (Bhukta, 2020). It influences many aspects of life, including the choice of staple foods. Deeply ingrained in Papuans' psyches, the knowledge encourages them to keep sago as their staple food even when they migrate to a new area (Delfi & Weintré, 2014).

Local foods are different from traditional foods in that the former is heavily influenced by the external community and the availability of raw materials. Nonetheless, both traditional and local foods are essential in fulfilling the nutritional needs of the community (Rocillo-Aquino et al., 2021; Vicziany & Plahe, 2017). Traditional foods are also an integral part of the culture and help attract tourists

worldwide (Lestari & Yusra, 2022). They not only shape the local character but also boost the local income. The variety of traditional food sources in Papua is wide owing to the province's richness of natural resources (Kadir et al., 2022a). In the lowland areas of Papua, sago (Metroxylon Sago) is a popular staple food. In the remote part of the island, sweet potatoes called batatas (Ipomoea batatas) is more common, cooked in a traditional burning coal method called *barapen*. Between these two, sago has become more widespread across Indonesia and is no longer solely associated with Moluccan and Papuan cultures. At least 59 sago-based foods are spread throughout Indonesia (Kadir et al., 2022b), including papeda, roasted sago or sago plates, and sago sep.

In brief, sago is an important part of Marind Anim's lives and culture, so it is important to map diversity to preserve traditions. This is even more pressing because the demand for sago has been increasing to be used as a raw material for the food industry (Metaragakusuma et al., 2015), which may disrupt the supply chain of the raw material in the community. Previous research in this area tends to question athletes (Guntoro & Putra, 2022; Guntoro et al., 2023), sports students (Wandik et al., 2024; Guntoro et al., 2024), sports psychology themes (Putra, Wanena, et al., 2024; Sutoro, Guntoro, & Putra, 2023; Putra & Guntoro, 2022; Putra, Kurdi, et al., 2024; Putra, Sutoro, et al., 2024), and theme of sporting events (Kogoya, et al., 2024a; Kogoya, Guntoro, & Putra, 2022; Kogoya, et al., 2024b). Studies on the theme of traditional food sources and those linked to sports have not been explored much, even though this issue is interesting and important considering that Papua is very rich in various traditional foods and is often referred to as a storehouse for athletes.

Therefore, this study examines the diversity of sago-based traditional foods among the Marind Anim people in Merauke, including the newly nationally recognized staple food: Sago Sep. In addition, the nutritional value and potential of sago sep as food for athletes will be explored in more depth.

Materials and Methods

This research was conducted between 2022 and 2023 in Merauke Regency, South Papua, Indonesia (Figure 1). The survey locations covered several districts and villages in the Merauke Regency, Merauke District, Muting District, and Tanah Miring District. These districts were chosen because they are centers of sago cultivation and distribution of the Marind Anim tribe in the Merauke region. The aim was to uncover the use of sago as a staple food to help ensure local food security and support national food sovereignty. This study uses a qualitative approach with data collection techniques through fieldwork research, interviews, focus group discussions, and rapid appraisal, which combines ethnographic and food culture approaches.

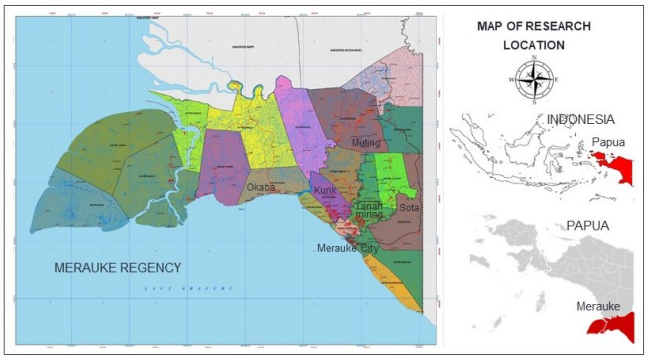

Figure 1. Research locations in the lowland areas in Merauke, Papua, Indonesia.

The visits were conducted in sago sales markets and sago production sites. The approach was kept informal to ensure that the respondents were relaxed. Information was also documented during the direct observations. Sixty respondents were involved in the survey. The questionnaire revealed detailed information regarding Sago Sep and other sago-based foods, as well as the cultural values and traditions attached to the food products. The semi-structured interviews were conducted with sago flour producers, sago food producers and consumers, and the indigenous peoples. There were five main dimensions revealed in the interviews, such as the local name of the food (e.g., What are the local terms used to refer to this food?), the cooking process (e.g., How do you process sago into food?), texture (e.g., Is there a difference in taste between food styles such as round plate, long?), function and use (e.g., What cultural function is associated with each category of sago food?), and ritual aspects (e.g., Are there portions rituals carried out by the Martid indigenous people before bolting and processing sago food?). Each informant was asked this question but it could develop according to the context of the informant's answer. The interview results were then analyzed using the Miles and Huberman qualitative analysis technique (Miles & Huberman, 1984).

Results and Discussion

Diversity in the traditional foods in the Marind Anim tribe

The results showed that the Marind Anim tribe in Merauke utilized sago flour to create various food variants, namely papeda (Figure 2), roasted sago or sago plates (Figure 3), and sago sep (Figure 4). The interview results show that sago-based special foods are common for the Marind Anim people in Merauke for a long while. The investigation also highlights that sago sep was originally developed by the Marind Anim indigenous people in Merauke.

Meanwhile, papeda is recognized as a typical cuisine of the northern coast people, and sago plates are known to originate from Maluku (Molucca). For the Marind Anim tribe, papeda and sago plates are better known as modified dishes originating from the northern Papua and Molucca, brought by the people migrating to Merauke long ago.

According to Tulalessy (2016), papeda is a special food in Papua, Maluku, and Sulawesi. Regardless of the place of origin, the porridge-like papeda is popular among the people in Eastern Indonesia.

Papeda: The sago porridge

Papeda, also known as the sago porridge, is served with yellow fish soup (with turmeric coloring), vegetables (usually *kangkong*, *Ipomoea aquatica,* papaya flowers, *Carica papaya*), and chili sauce (Figure 2). Cooking papeda is simple, so this dish is classified as ready-to-eat food. However, the side dishes take time to prepare: fish soup, vegetables, and chili sauce. Papeda can be made from wet flour, which is widely available in traditional markets, and dry sago flour, which can be found in traditional markets and supermarkets. However, papeda from wet sago flour is preferable.

Figure. 2. The Papuan foods with sago as the main ingredients: a) sago porridge, b) fish soup, c) vegetables, d) chili sauce, e) complete serving of papeda. Papeda's complete dish consists of sago porridge, fish soup, and vegetables. Chili sauce can be added for spicy tasting as desired.

Sago flour is dissolved and rinsed in clean water. After that, it is sifted so that the flour to be cooked is the refined grains. Next, the wet flour is drained and put in a saucepan. Boiling water is added little by little while stirring continuously. The process stops only when the mixture has expanded with a glue-like consistency. No spices are added to keep the papeda's taste plain, like other porridge dishes. The taste of papeda comes from the fish soup and sauce instead. Therefore, yellow fish dishes often require more ingredients and spices. In serving papeda, the fish soup is added to the plate. Then, papeda is scoped using a special papeda stirrer and a tablespoon and added to the plate. Next, vegetable and chili sauce are added to taste.

Most indigenous Papuans initially served papeda to entertain special guests in banquets for special traditional events. However, people can now cook papeda on various occasions without hosting special guests or celebrating certain traditional events. Papeda is also commonly available in some restaurants in Papua.

Roasted Sago or Sago Plates

Roasted sago or sago plates are also typical Papuan foods. The name is self-explanatory, meaning it is made by roasting the sago. First, sago is cooked in a mold, i.e., plates (Figure 3). According to Tulalessy (2016), sago plates are dry cakes that can be eaten immediately to accompany hot tea or coffee. In other areas, these are served with a fish sauce for dipping.

Figure. 3. Roasted sago or sago plates cooked by the Marind-Anim people in Merauke. This typical Eastern Indonesian food is made from sago flour as the main ingredient, mixed with grated coconut, and is usually served with hot coffee or tea.

For the indigenous people of Marind Anim, sago plates are served daily. They do not consider that the food is originally from the Marind Anim people but was brought by the migrant communities from the Maluku (Molucca) Islands. The Molucans have indeed inhabited the area since the Dutch era. They brought the sago plate cooking traditions to Papua. The advantage of this food is that it can last up to several weeks. The plates are reddish and plain. However, along with the development of people's culinary tastes, this food is now available in various flavors, such as brown sugar or palm sugar.

Cooking sago plates is relatively easy by roasting them in rectangular iron molds. The ingredients are a half kilogram of wet sago flour, grated coconut, refined salt, and water. First, the sago is roasted in a large cauldron until slightly dry. Then, grated salted coconut is added. While being stirred, water is added. The mixture is then put in a mold that has been heated on the fire. After one side turns yellowish, the is turned over. After both sides are cooked, the sago plates are removed and served. They can be paired with sweet tea or coffee. In some areas, they are served with savory side dishes, such as salted fish, tamarind and eggplant sauce, or grilled fish.

Sago Sep

Sago Sep originates from the lowland area of Merauke, as opposed to papeda, which is popular in northern Papua. These food preferences may depend on the culture (Diana et al., 2018). People in this area are familiar with hunting and gathering culture. The protein is obtained from hunting in the forest, while the source of carbohydrates comes from gathering. Sago is collected by extracting the plants in the forest. The lowland region of Merauke has other natural resources, including coconuts, kangaroos, deer, various

types of fish, and wild boars (Barri et al., 2019). Coconut plants grow along the coast, whereas kangaroos, deer, and wild boars are common games (A. Kadir et al., 2022b).

Sago sep is mainly made from sago and coconut. The coconut can be either grated old coconut or shredded young coconut. The interview indicates that the community prefers to use young coconuts. Other ingredients are coconut water, fish and meat, sugar, and salt. The sago flour is usually wet. Modern machine tools to extract sago from plants produce less tasty starch than the traditionally extracted sago starch. That is why indigenous peoples prefer to use flour from the traditional extractor.

The ingredients are one kilogram of sago flour, eight to ten coconuts, three tablespoons of sugar, one teaspoon of salt, and one cup of coconut water. Meat or fish can be added, which amounts to one kilogram. At first, the sago is sprinkled with coconut water to make it slightly wet. Then, the sago flour is mixed with salt and sugar. Next, the shredded coconut is added and stirred evenly. The dough is compacted on a baking sheet lined with banana leaves with a height of around 2.5 centimeters, the width, and length according to the baking sheet. The dough is wrapped and baked in an oven for around 30 minutes. After cooking (Figure 4), the sago sep is cut into rectangular or square sizes. There are several variants of sago sep depending on the ingredients (Table 1). For example, sago sep Komabo is made by adding meat, such as beef, deer, kangaroo, or pork, to the sago sep dough (Figure 6).

Figure 4. Sago sep cooked on a small scale using an oven. a) cooked sago wrapped in banana leaves, shaped like a box with a thickness of about 2.5 cm, b) after being in the oven, the sago sep is served by cutting it into smaller sizes.

The indigenous people cook sago sep on a larger scale (Figure 5) for traditional ceremonies, such as wedding receptions, banquets for special guests, and church or village events. To cook sago sep on a large scale, they usually cook it using *barapen* using stones or bus wood (*Melaleuca* sp.) (Suharno & Kadir, 2023), which grows abundantly in the lowland areas of Merauke. This plant can grow and adapt in swampy areas and is widely used by the Marind Anim people.

Figure 5. Cooking sago together in traditional events: a) sago that has been mixed with meat, b) sago and meat wrapped in banana leaves, c) the process of cooking sago by placing it on the pad and covering it with hot stones and bus wood (*Melaleuca sp.*), d) After several hours of cooking.

Table 1.
Variants of sago sep produced by the Marind Anim people in Merauke, Indonesia.

No	Food products	Ingredients	How to cook
1.	Sago sep: *Teta*	Sago and cooked bananas	Bananas that have been boiled are mashed, then mixed with sago until it thickens The concoction is wrapped in banana leaves The banana leaves are smeared with oil so it does not stick Then sago sep is roasted (in *barapen*)
2.	Sago sep: *Komabo*	Sago, meat, and coconut	The meat is cut into small pieces The meat is mixed with sago and coconut The concoction is cooked by the fire (barapen) When the cooked meat is used, it is called *Wanngilamo*
3.	Sago sep: *Nggalamo*	Sago, coconut, meat, coconut milk	The meat is cut into larger pieces When the *Nggalamo* is mixed with coconut milk, it is called *Kaka*
4.	Sago sep: *Ebayak*	Sago and water	The sago flour is slightly moistened, so it is a bit sticky The concoction is made into round shapes The sago sep is roasted until it turns brown
5.	Sago sep: *Kwetahuk*	Sago and water	The sago flour is slightly moistened, so it is a bit sticky The sago is poured into a pan that has been heated (without oil) The sago sep is shaped like an omelet
6.	Sago sep: *Sinoli*	Sago and grated coconut	The sago flour is mixed with grated coconut The mixture is fried in a pan (without cooking oil) until it turns brown

Figure 6. *Komabo*, meat-based sago sep. a. Komabo cooking preparation, b. ripe kombo, and c. Komabo served. Sago sep is usually served in important traditional events in the Marind Anim tribal community. The quality is often higher than other sago foods due to its nutritional content.

An area with the same geographical characteristics tends to produce similar foodstuffs (Suparmo, 2004). In the southern region of Papua, where the Marin Anim people live, sago plants grow naturally. In the mythology of the Marind Anim tribe, the sago plant was born from a supernatural figure (Muller, 2011). Therefore, the sago plant is magical and sacred. The presentation of sago, such as sago sep, is aimed at ceremonial events served to the closest family relatives and guests, such as commemorating the 40th day of the death of a relative or traditional party ceremonies.

Sago as the Glue for Indigenous Peoples' Relations

Every food has a story behind it. Eating is a fundamental biological need humans have to fulfill to survive. Apart from that, food is also a means of cultural communication (Utami, 2018; Govindasamy et al., 2018). Food also has a social role, a standard of wealth, a barometer of social status, and a symbolic mediator in defining and manipulating kinship and social relations (Nutri 2017). Davis (1995) on the Minangkabau community, Kadir et al. (2022b) in the Marind Anim Society, have shown that food is a cultural element that shows social relations. For the Marind Anim tribe, sago is the guarantee of life and the survival of humankind. Even the existence of sago as a staple food source is also a symbol of the identity and culture of the Marind Anim people.

Totems are certain animals, plants, or natural phenomena seen as the first ancestor of a clan or other genealogical units (Kadir et al., 2022a). For the Marind Anim people, each clan has its ancestral totem. The Sago totem is held by the Mahuze clan and is seen as something sacred and must be treated properly according to customary provisions. Therefore, the Mahuze clan bears the sago plant as their totem and is recognized by all clans in the lowlands of Merauke. This customary agreement is important in maintaining and preserving sago plants as a food source for the local communities.

The food reflects the community's cultural characteristics. In traditional communities such as the Marind Anim tribe, sago food is a glue for social relations among clans, especially in traditional ceremonies such as funerals, marriages, and conflict resolutions. Sago must be served in a way that shows affection, attention, and friendship. For the Marrind Anim people, eating together is the essence of a communal culture that can maintain their survival. Therefore, sago must be presented as it will bring a sense of completeness. Fulfilling this becomes an obligation and social responsibility for those who carry out the ritual (Kadir et al., 2022b). This highlights the importance of the relationship between families, clients, tourists, and incomes in opening a food business that involves traditional food (Wijaya, 2019). Traditional food will be known by many people, and demand will emerge periodically until finally, the preference for this food is driven by the people's interests (van Dongen, 2019).

Nutritional value of sago and its potential as an alternative food for athletes

The following is a comparison of the nutritional value of sago and other food ingredients.

Table 2.
Nutritional value of sago and several food ingredients per 100 grams

Component	Sago	Rice	Potato	Corn
Carbohydrate (g)	85.2	82.3	13.5	79.5
Protein (g)	0.9	2.7	2.1	8.8
Fat (g)	0.3	1.1	0.2	0.5
Calorie (Kal)	347.00	350.00	62.00	357.00
Water (%)	13.5	11.00	83.4	11.0

Source: Ministry of Health (2017)

As is known, athletes' energy needs to exceed the average human being in general. It is not uncommon for male and female athletes, especially those who are still growing, to have calorie needs exceeding 2,400-3,000 kcal and 2,200-2,700 kcal per day. The amount of energy found in food certainly depends on the macronutrient content (carbohydrates, protein, and fat) of each food. Therefore, every athlete needs to pay attention to what they need to consume.

Carbohydrates serve as the main energy source during higher-intensity activities. Carbohydrate requirements for athletes depend on total energy expenditure, type of exercise, and environmental conditions (Dunford & Doyle, 2022). Generally, athletes' carbohydrate needs are 60-70% of their total energy needs (Burke et al., 2004). Food sources of healthy carbohydrates include fruit, vegetables, whole-grain cereals, bread, and pasta. What about the carbohydrates in sago? The carbohydrate content in sago is higher than that in several other types of food, namely 85.2 g (Table 2). This indicates that for carbohydrate needs, sago can be an alternative food for athletes because of its high carbohydrate content.

Apart from carbohydrates, dietary protein also plays an important role in muscle repair and growth. One-fifth of the body consists of protein, half of that is found in muscles and one-fifth is found in bones (Penggalih et al., 2020). A person's protein requirements are generally around 0.8 grams/kg body weight, while the requirements for athletes are 1.2-1.7 grams/kg body weight (Rosenbloom, 2009). High sources of protein are found in fatless meat, eggs, milk (yogurt, milk, cottage cheese), and nuts. In sago, the protein content is lower compared to other food

ingredients, namely 0.9 g (Table 2). However, regarding protein needs, it is recommended to combine various types of protein to support muscle development well (Penggalih et al., 2020). Therefore, regarding protein needs for athletes, they need to consider and combine it with other food sources that are high in protein, such as meat, eggs, and milk.

Dietary fats also play an important role in helping individuals meet their energy needs. Fat from food contributes 34% of energy to the body (Penggalih et al., 2020). Athletes should consume fat, as much as 20-30% of their energy needs, however, athletes who need to reduce body fat can consume 20-25% of their total energy needs (Dunford & Doyle, 2022) and less than 15% will interfere with performance. Sources of healthy fats include nuts, peanut butter, avocado, olive oil, and coconut oil. For sago, the fat is not high, namely 0.3 and this is smaller than rice and corn but higher than potatoes (Table 2). Therefore, regarding fat needs for athletes, they need to combine it with other food sources that are high in fat, such as nuts and avocados.

Thus, sago can be an alternative source of food for athletes, especially in eastern Indonesia, because of its high carbohydrate and calorie content, but this needs to be combined with other foods to support their energy needs. Athletes from eastern Indonesia are used to consuming foods made from sago so this will not be an obstacle. However, for athletes who come from central or western Indonesia, processed sago may not be suitable because this is related to culture and habits in society.

Conclusions

In general, it can be concluded that the Marind Anim community, indigenous people in Merauke, have plenty of natural resources, such as sago (*Metroxylon Sago*), which can be utilized as a traditional food source. Sago flour is used to make traditional foods, such as papeda, roasted sago or sago plates, and sago sep. Papeda and roasted sago are foods made by migrant communities such as those from northern Papua and Maluku. Sago sep is a typical food of the Marind Anim tribe, which has been cooked for generations. The main ingredients are sago flour and coconut. Sago sep's varieties are *Teta, Komabo, Nggalamo, Ebayak, Kwetahuk,* and *Sinoli*. The variety of names corresponds to the additional ingredients. Sago flour has the potential to be developed as a food raw material on a household and industrial scale and can even be used for the needs of other industries. Apart from that, sago can be an alternative source of food for athletes, especially in eastern Indonesia, because of its high carbohydrate and calorie content, but this needs to be combined with other foods to support athletes' energy needs.

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Datos de los/as autores/as y traductor/a:

Akhmad Kadir	akhmaduncen@gmail.com	Autor/a
Suharno	harn774.uncen@gmail.com	Autor/a
Yohana I. Reawaruw	yoh.reawaruw.uncen@gmail.com	Autor/a
Aisyah Ali	aaisyahali05@gmail.com	Autor/a
Miftah Fariz Prima Putra	mifpputra@gmail.com	Autor/a
Eduedit	mail@eduediting.com	Traductor/a