Proximate composition of Pekasem/fermented barnacle from Bangka Belitung

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Abstract. Barnacle is commonly known as biofouling marine organisms attached to hard surface material such as vessels, rocks, wood, and shells. Despite being studied as a biological fouler, some villages in Bangka Belitung Islands Provinces process the barnacle meat into one of the fisheries products called Pekasem. Pekasem is a fermented barnacle with a flavor and scent of salt, sugar, and bay leaves. Fresh Barnacle meat fermentation typically lasts 2-4 days in a closed jar at room temperature. This study aimed to determine the proximate composition of food ingredients produced by fisheries from community groups in Permis, South Bangka Regency Bangka Belitung. This information becomes necessary in fisheries food products that must be included in the packaging of Pekasem. The test results showed that 100 g of Pekasem products contain protein 7.88 g, fat 5.53 g, carbohydrate 6.03 g, moisture 72.87 g, and ash 7.69 g.

1 Introduction

Groups of barnacles are sessile marine organisms often found on hard surfaces such as rocks, piers, boats, and moving animals like whales and turtles. Once adhered to the fixed objects, the barnacle releases the glue made from proteinaceous sticky cement [1]. The effects of barnacle attachment on a boat, dock, or vessel can reduce the boat's speed, and fuel efficiency, damage the boat paint, which leads to metal rusting, and eventually reduce the boat's lifespan [2]. Despite the negative impact, barnacles have some ecological importance to the food chain. Barnacles are filter-feeder crustaceans and play a significant role in the ocean, and they help clean the ocean as they filter the food. Another role of barnacles is as a potential source of protein for human delicacy. Several villages in Bangka Belitung Province, such as Batu Belubang in Central Bangka, Permis in South Bangka, and West Bangka Regency, use barnacle meat as a fishery product.

Bangka Belitung Islands Province is located on the South East side of Sumatra Island. Bangka Belitung has 2 main islands, Bangka and Belitung, with a total area of 81,582 km^2, which come under a land region of 16,281 km^2 and 65,301 km^2 of the ocean (Central Bureau of Statistics of Bangka Belitung Prov, 2019). This indicates the high marine and fisheries

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potential to increase the provincial development. Bangka Belitung has high production from the catch and aquaculture sector. In addition, potential fisheries processing products also need to be contemplated. One of the sample products is Pekasem/ fermented fisheries, either from fish, shrimp, mussels, or barnacles.

In an anaerobic environment, Fermentation occurs when microorganisms, such as bacteria and yeast, convert carbs (starch or sugar) into alcoholic or acidic foods. The alcohol or acids act as a natural preservative, giving distinct zest and tartness. Fermentation also promotes the growth of beneficial bacteria, known as probiotics which are useful for our body. To conclude, besides changing or enhancing the product taste, fermentation will also preserve the foods by natural process. One common product of fermentation in Bangka Belitung is rusip and Pekasem, fermentation uses small fish, usually called rusip, meanwhile Pekasem uses mussels or barnacles. The making process of both rusip and Pekasem are almost the same, including the ingredients, except for the fermentation process of each resource, small fish and barnacles need usually 2-4 days for the anaerobic fermentation process. However, mussels take 1-2 weeks to reduce the bitter taste from the Balanus sp. The majority of Bangka Belitung villagers work as a fisherman who depends on the fisheries sector to create processed fish products as the central component of its economic actions. Located near the shoreline will ease the fresh raw materials collection, like fish, mussels, and barnacles, especially *Balanus* sp which pose as major fresh components for the production of processed fisheries products in this district.

The community service activities were conducted to analyze the processed products from Permis village, South Bangka Regency. The analysis focuses on product distinction of nutritional composition of Pekasem to offer information also simultaneously offer value-added for the society and the consumers. From this community service, it is hoped that there will be suggestions and input for the development of the processed product regarding the information on the values of nutrition and simultaneously offering a creative idea on attractive and informative label and packaging designs.

2 Materials and method

Descriptive and observation method was used in writing this research as a part of community service activity in Bangka Belitung. This approach is carried out by representing Pekasem as one of the processed fishery products from Permis Village in the South Bangka Regency. At the same time, it provides suggestions and input to escalate the packaging process and eventually the price of local products for the consumers based on product quality application standards.

The community service activity was executed in July 2023 in Permis Village South Bangka Regency, Bangka Belitung Islands Province. The community service partnered with the women's community in Permis Village which collects Balanus sp. and under way the Pekasem processing product. The research report will focus on the results of the nutritional composition of barnacle Pekasem after 2-3 days of fermentation. The freshly made Pekasem was sent to a regional health laboratory in Jakarta (Labkesda Jakarta) for proximate analysis, including the contents of protein by using the titration method, carbohydrate with difference method, fat by using the Kjeldahl method, moisture and ash together with gravimetric based on National Standard of Indonesia (SNI) 01-2892-1992 [11].

3 Results and discussion

3.1 Process of making Pekasem

Pekasem is a product of fermentation from *Balanus* sp. from groups of barnacles as an essential raw material. The first step is separating the barnacle meat from the hard shells by using a knife or an awl. After that, wash the barnacle with clean water 2-3 times until the mucus is lessened. The barnacle was then placed in a wide strainer to dry the excess of the water. Later, the barnacle is mixed with salt, bay leaf, sugar, and squeezed thoroughly (Figure 1). The role of bay leaf is to reduce the fishy smell of *Balanus* sp., meanwhile, salt acts as natural preservation besides providing taste together with sugar. The mixture is then stored in a closed container such as a barrel or other closed container for 2-4 days. The containers need to be clean washed before use.

Fig 1. Cleaned barnacle's meat, then mix thoroughly with salt, sugar, and bay leaf in a small container

Pekasem that is ready to be consumed will produce a distinctive smell and taste sour and salty. Villages in Bangka Belitung usually consume Pekasem as a side dish. To devour Pekasem, take one or two spoons of Pekasem from a jar and mix with chili slices and lemon squash to increase the savoriness. The Figure 2 below shows Pekasem after formulated with chili and lemon squash, this dish is also widely consumed as a chili sauce during the meal. Several families in Permis Village cook the Pekasem with some vegetables to escalate the flavor and at the same time beneficial nutrients from the vegetables.

Fig 2. Pekasem is ready to consume with additional chili and lemon (left), the packaging design of a 300ml jar is to be distributed to the consumers (right)

Globally fermented food is very well known as it produces different flavors and increase food durability. Similarly, seafood fermentation has been very popular and widely done in several countries to increase the storage span of fish meat and to be distributed extensively without cutting the taste. Seafood fermentation usually use meat, is Salt-fermented fish is produced by fermentation of the meat, mass visceral, or entire body of fish, mollusc, and shellfish by groups of microorganisms or hydrolysis enzymes (3). During the early fermentation process, protein bonds were broken down by the molecule of water, this step depends on the proteolytic enzymes from the seafood [4]. The proteolysis process will produce unique fragrance and flavor from soluble nitrogen compounds like amino acids, nucleotides, peptides, and decay products [3,5]. The series of this process is essential to generate the exact taste and flavor during the fermentation mechanisms. Salt fermented seafood contain valuable nutrition because it produces amino acids and minerals in high numbers. In Bangka Belitung, the fish fermentation products have been widely used to make Rusip (fermented anchovies), Calok (fermented shrimp, Pekasem (fermented barnacle, fermented mussels) for side dish during meal and additional seasoning for cooking.

3.2 Proximate content of Pekasem

The result of the proximate analysis shows the composition of total protein, fat, carbohydrate, moisture, and ash with the method based on PP.16.22-PROKSI/17025/LABKESDA SNI 01-2891-1992 (shown in Table 1).

Table 1. The nutritional content of Pekasem from Balanus sp. sample

Parameter	Result	RDA*	%RDA
Total Protein	7.88 g/100 g	8 g	13
Total Fat	5.53 g/100 g	6 g	9
Total Carbohydrate	6.03 g/100 g	6 g	2
Moisture	72.87 g/100 g	-	-
Ash	7.67 g/100 g	-	-

*RDA =Recommended Dietary Allowances

As listed in Table 1, the total protein content is quite high 7.88 g in 100 g Pekasem. Protein consists of amino acids and has an essential role for the body in the growth process a chain of amino acids needed by the body. Protein has an important role in growth [6]. The total protein content of bekasem from the barnacle is in correspondence with the National Standard of Indonesia (SNI 01-2891-1992) 13% for the maximum. Another fermented seafood product of Bangka, Rusip, contains protein compounds of 10.52% and up to 14.45%. The different concentrations of protein in each seafood fermented product might due to different of salt and sugar concentrations before the fermentation process.

The fat content of Pekasem is 5.53g in 100 g Pekasem products and still below the percentages of Recommended Dietary Allowances (RDA of Indonesia). Fats is a lipid consisting of trimesters of glycerol and fatty acids or triglycerides. Many researchers mentioned that fat is an effective source of energy and calcium than carbohydrates, 9 kcal of energy can be produced by the combustion of 1 gram [8]. There may be different fat content in Pekasem caused by different types (species and size) of barnacles [9].

The total moisture in the Pekasem product has the highest content compared with other parameters, with 72.87 g in 100g Pekasem. Different levels of water/moisture content are characterized by prefermentation process, starting from cleaning and drying the Balanus sp. samples out from the excess moisture. The drier the raw Balanus sp. samples the less moisture content in Pekasem byproduct. The ash content of Pekasem is 7.67 g in 100g serving, ash is

widely known as a mineral element or organic matter. Ash is one of the essential components in food as it consists of varied minerals like phosphorus, sodium, calcium, and copper [10].

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