BUAH MERAH DAN PENDUDUK PAPUA

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BUAH MERAH AND PAPUAN PEOPLE

ABSTRACT

Buah merah is called red fruit (Pandanus Conoides Lam) was reported it has been used Papuan peoples since a hundred years ago as processing aids in food processing by potato, meat and vegetables by extraction of red fruit to become a paste. Buah merah or red fruit is known it much contains carotene, fat and vitamin E, in addition it contains a small member of protein, carbohydrate and mineral. While, red fruit oil contains four types carotenoid i.e. alpha-carotene, beta-carotene, alpha-cryptoxanthine and beta-cryptoxanthine. This article will review about the history of buah merah or red fruit, the nutrition value content and the benefits and safety of buah merah.

Keywords: Buah Merah, carotenoids, extract

ABSTRAK


Kata kunci: Minyak Buah Merah, karoten, ekstrak

INTRODUCTION

What are Papuan People?

It is said that presently living human race, Homo sapiens was born approximately 200,000 years ago in Africa. They were out of Africa from 100,000 years ago and immigrated to various directions in the world. Some groups moved to Eurasian continent passing through Central Asia and finally reached to Siberia about 25,000 years ago. They were the ancestors of Caucasians.

Some groups passed along the shores of Indian Ocean and arrived at South East Asia around 60,000 years ago. They are considered as ancestors of Mongoloids. At the time, the earth was colder and sea levels were lower than the present time. Almost all of the western islands from Bali island in now a days Indonesian archipelagos were not separated from Asia continent, but formed one continental Sunda.

Island of Papua was combined with Australian continent and formed Saful continent. It was not difficult for the immigrants from Africa to reach to west and north parts of Saful continent with a simple raft. Their descendants are Papuan people and Australian Aborigines.

Some groups of Africans forwarded to north from Sunda continent and about 10,000 years ago they arrived at the edge of
South America passing through Beringia (Bering strait without glaciers) and North America.

Along with global warming and rising the sea levels, the continents of Sunda and Saiful disappeared and the present geographic terrains were formed before 10,000 years.

Thus, the present native Papuan people, classified as Australo-Melanesian with language of Non-Austronesia, often called Papuan, have been inhabiting in Papua island for at least 50,000 years[1] and [2].

In Papua, four broad categories of ecological environment can be recognized: swampy areas, coastal lowland, foothills and small valleys, and highlands. Each of these zones supports different subsistence systems.

This article focuses on people in the highlands in conjunction with Buah Merah (meaning red fruit). In the highlands, farming and raising pigs is the primary subsistence strategy.

Some families of the immigrants after landing on Papua island moved up to the highland areas, at more than 1,500 m from sea level, possibly to avoid deadly disease Malaria, at least 32,000 years ago. With warming climate, the forest became thicker and highlands were isolated from lowland areas.

The inhabitants at the highlands, had been surviving under terrible conditions; cold climates, naked wear styles, poor animal foods, simple house etc. until they were introduced to the world as prehistoric humans in 1938. At this time, however, population of the highlanders, Dani tribe in Baliem valley was reported to be 50,000, one of most high density areas in Papua [3] and [4]. So, the purpose of this article is to review and internet relatively recent research on nutrition value, safety and benefits of Buah Merah oil.

Buah Merah is a common food of the highlanders

One of the reasons why huge number of people could survive was their farming skill of sweet potato introduced 500 years ago. Sweet potato is quite good food to maintain and support population. However, questions remained. One Christianity person noticed another reason why the highlanders have been surviving under cold and poor conditions. His conclusion was Buah Merah that is daily taken and common fruit for the highlanders.

Taxonomy of Buah Merah plant is as follow:

Division : Spermatophyta
Class : Angiospermae
Order : Pandanales
Family : Pandanaceae
Genus : Pandanus
Species : Pandanus conoideus Lam.

Buah Merah is the name of Indonesian language, meaning Red (Merah) Fruit (Buah). The highlanders in Baliem valley, Papua call it "Tawi" or "Watawi".

The characteristics include one trunk with many roots derived from the trunk above the earth. The roots sometimes have 150 cm in height and support the trunk. Therefore, this type of plants are named from Octopus. The
tree reaches more than 15 m with abundant leaves. Buah Merah tree has less than 5 branches with thorns. The leaf is dark green with 5–10 cm in width and becomes 150 cm in length. The edges of leaf are spiny. After a flowering, a green fruit wrapped with green leaves is getting matured and appears from the leaf sheath to be ripened, brown to red color at 6 months old.

A big longitudinal fruit is around 1 m in length, 20–30 cm in diameter and 10 kg in weight. The flesh on the surface is 2–3 cm in thickness. The part of meat around bullet-shaped seeds is 2 mm only in thickness. 
There are some varieties in Buah Merah inclusive of short-, medium- or long-sized ones. In the highland of Baliem valley, the local Papuans cultivate and utilize the most economical and nutritious long-sized fruits. Now, the dwellers living in lowland areas transferred Buah Merah trees from the highlands and plant them, but it is believed that the fruits grown at highlands of Baliem valley and its vicinity are best in terms of nutrition because of climates. The temperatures in the highlands are 14 to 28 °C in lowest and highest averages, and it rains slightly compared to the lowlands.

The highland people collect Buah Merah fruit whenever the fruit is matured. The fruit is harvested two times a year. Harvesting time varies from areas to areas. Therefore, they are able to take Buah Merah almost all the year around.

The Buah Merah fruits are cooked in their traditional way to make Pasta source. It is said that the excess Pasta is stored in a bamboo container and used for one year. Nowadays, the Pasta or extract oil is kept in a glass bottle.

The Pasta is ingested with steamed and/or roasted sweet potato, taro or vegetables. In a few occasion such as marriage and special ceremonies, buah merah is cooked with their traditional cooking way, Bakar Batu in Papuan language, cooking with heated stones. This cooking method might be spread to Polynesia from Papua or Melanesia.

Figure 5. Buah Merah pasta/oil in glass bottles

Figure 6. Stones are heated with fire

Figure 7. Heated stones are placed inside grass-made oven
In Bakar Batu, the heated stones are placed between each food material and they are not directly attached to the food materials by putting glasses between the stones and food materials. After the flesh of Buah Merah fruit is heated with hot stones, it is separated from underlying fibrous layer and then water is put in the flesh. The flesh is vigorously mixed and squeezed with hands to separate the fruit meats from seeds and obtain the Pasta. The Pasta is a mixture of Buah Merah oil and cellular matrices. The Pasta is used as source for cooked meat, potatoes and vegetables.
Distribution of Buah Merah in Papua

From our investigations, Buah Merah is relatively widely planted in entire Papua from the highlands and lowlands. But the highest density is seen at the highland areas including areas of Baliem valley, Maoke mountains and Arfak mountains where the plants are naturally grown or cultivated. Among these mountain areas, Buah Merah trees are tended in Nothofagus forest over the range of 1500–2800 m above sea level. However, Buah Merah is traditionally taken as daily foods in Baliem valley and its vicinity areas and Maoke mountains areas only. In these areas, local government and Christian association recommend the native folks to plant Buah Merah trees for their health and sales.

People living in the lowlands have no custom to receive it, and Buah Merah fruit is not easily accessible and available for the lowlanders.

![Figure 13. Map of Papua](image)

Within Papua in Indonesian territory, there are three main areas encircled for Buah Merah.

Buah Merah trees are naturally grown and specifically cultivated in the highland areas of Papua as described above. They seem likely to be originated in Papua and to be rare and unique plant species. Therefore, Buah Merah is forbidden to bring it out of Indonesia and to get any patent without permission of Indonesia Government.

In 2007, Center for Agro-Based Industry, Ministry of Industry, Indonesian Government and M&K Laboratories Inc., Japan entered into Material Transfer Agreement (MTA) based on biodiversity treaty of the United Nations, 2003. In addition, Buah Merah is subject to collaborate in research and development following Memorandum of Understanding (MOU) with both parties.

Nutrition Values of Buah Merah

There are documentations and published books on nutritional analyses of Buah Merah extract in Indonesia. We had questions on those data and could not trust them. Complete analyses of high quality Buah Merah oil were conducted at reputable laboratories in Japan, outsourced
by M&K Laboratories Inc. The quantitative analysis method of carotenoids in Buah Merah oil has been developed and analyzed by co-working team of Faculty of Pharmacy, Nagasaki University, headed by former vice-president of the University, Prof. Dr. K. Nakashima (he is now Professor of Nagasaki International University).

From these results, Buah Merah oil is rich in carotenoids, lipids and vitamin E. All are lipids and lipid soluble ingredients. The contents of proteins, carbohydrates and minerals are scanty. Total carotenoid level is more than 200mg/100g. Vitamin E is about 20mg/100g that is the highest among oils extracted from any other fruit meats.

It was found that Buah Merah oil contains 4 types of carotenoids; alfa-carotene, beta-carotene, alfa-cryptoxanthin and beta-cryptoxanthin. Among them, beta-cryptoxanthin level is the highest. This is the first evidence that Buah Merah contains alfa-cryptoxanthin and beta-cryptoxanthin.

Fatty acid analyses of Buah Merah oil disclosed that fatty acid constituents resemble to those of animal fats and no trans-fatty acids are not found [9].

Thus, Buah Merah is good sources of pro-vitamin A carotenoids, vitamin E and lipids which can be comparable to animal fats because of similar fatty acid compositions. The lipids of Buah Merah oil may enhance absorption of carotenoids from the guts without additional ingestion of oil.

Buah Merah oil can be extracted from oil droplets of cellular matrix without use of any synthetic chemical and at low temperature.

We recognize Buah Merah oil as purely natural food comparable with fruit itself. Buah Merah oil is a unique, natural food to provide 4 kinds of carotenoids and fruit oil.

**Safety of Buah Merah**

We speculate that Papuan people have been utilizing Buah Merah as the best source of fruit oil and micro-nutrients such as carotenoids and vitamin E until the present time for at least 30,000 years since they immigrated at the highlands of Papua, though they do not know what functional and active ingredients in Buah Merah are.

It can be said that their long time history and experiences of dietary use of Buah Merah can prove it very safe.

In addition to empirical reports, we investigated its safety as well as cooking and eating procedures on site in Baliem valley. Each family plants several Buah Merah trees at the garden and/or vicinity of house and collect one ripen reddish fruit and cook and make Buah Merah Pasta as mentioned in the above. Buah Merah trees have never been sprayed with pesticides and given synthetic fertilizers, but cultivated in purely natural way. One fruit was enough to serve for more than 10 persons’ meals. Roughly computing, the individuals intake 10–20 g at one time in Buah Merah oil basis, as about 200 g of Buah Merah oil is collected from one fruit. The Pasta is a mixture of cellular matrix including entire fruit components. The fibrous layer underlying the flesh was penetrated with Buah Merah oil and the people took even this part. We heard that nobody experienced carotenodermia and any other untoward events.

There are no reports on significantly higher-rated or abnormal adverse events
associated with Buah Merah, according to Papuan native people and health authorities so far we investigated.

Buah Merah oil is extracted from cellular matrix of Buah Merah fruit. Acute and sub-acute toxicity studies of Buah Merah oil were conducted using Sprague Dawley rats by oral administration according to OECD guidelines by M&K Laboratories Inc. Acute toxicity was not found at 2 ml/kg bodyweight of Buah Merah oil. In the sub-acute test, 0.1, 0.3 and 1 ml/kg bodyweight of the test substance were given to the rats for 28 days, but no untoward findings caused by the test substance were reported [10]. The mutagenicity study of Buah Merah oil disclosed no mutagenicity in base-pair substitution and frameshift types [11].

It is noticed that Buah Merah oil has been produced by paying most attention to hygiene, by considering the principles of international standards at the near site of Buah Merah cultivation areas, Wamena of Baliem valley. According to internal data of M&K Laboratories Inc., no pathogenic microorganisms are contaminated in Buah Merah oil.

The production method with possible modifications was applied for approval for patent by M&K Laboratories and CABI to Japan Patent Office in 2012. According to above-mentioned nutritional data, provitamin A carotenoids are concerned in safety issues.

The Linus Pauling Institute, Oregon State University in USA well-summarizes the safety of carotenoids [12], showing that high dose of beta-carotene (up to 180 mg/day) have been used to treat erythropoietic protoporphyria without toxic side effects. 30 mg/day or more of beta-carotene supplements and the consumption of large amount of carotene-rich foods have resulted in a yellow discoloration of the skin (carotenodermia). The risks of high-dose beta-carotene supplementation (20–30 mg/day) outweigh any potential benefits for chronic disease prevention, especially in smokers or other high-risk populations. There is no reason to limit the consumption of carotenoid-rich fruits and vegetables during pregnancy. Pregnant and breast-feeding women should avoid consuming more than 3 mg/day of beta-carotene from supplements.

University of Indonesia and Bandung Institute of Technology, Indonesia promise that Buah Merah oil dosage of 3 x 1 tablespoon per day (15 mL x 3 = 45 mL/day) is safe [12].

Safety of beta-cryptoxanthin has not been established, so far we examined. Beta-cryptoxanthin is naturally contained at contents of 3.6 mg and 0.4 mg per 1 cup (200 mL) in cooked pumpkin and fresh orange juice, respectively [13].

Buah Merah oil is comparable with natural fruit and its analysis results reveal that the contents of beta-carotene and beta-cryptoxanthin are about 5 mg/100g (0.05 mg/g) each [13]. One [1] mL/kg of rat bodyweight/day (60 mL or 54 g/60 kg human bodyweight) in 28 days consecutive administration does not show any toxic side effects [10]. Preliminary pharmacokinetic study of Buah Merah capsule form of oil showed that beta-carotene and beta-cryptoxanthin were relatively rapidly absorbed into blood of human subjects [14].
From these facts and history of use of Buah Merah by Papuan people, we can conclude that Buah Merah oil is very safe and the dose of 10 g/day may not cause any side-effects in human. In order to maintain health conditions and intake micronutrients, especially beta-cryptoxanthin from Buah Merah oil, it is recommended to receive 2 g/day in healthy persons, because average daily intake of beta-cryptoxanthin in American population is reported as 104 µg/day [16].

**Health Benefits of Buah Merah Oil**

Health benefits of provitamin A carotenoids are also well summarized by the Linus Pauling Institute, Oregon State University in USA [12]. It is well-known that high doses of beta-carotene (considered as synthetic substance, 20–30 mg/day) supplementation to smokers and/or workers with a history of occupational asbestos exposure increased the risk of lung cancers. In contrast, there are many reports that dietary intake of beta-cryptoxanthin was inversely associated with significant reductions in risk of lung cancer in cohort clinical studies.

Experimental animal studies demonstrated that beta-cryptoxanthin had ant-cancer effects in the large intestines and lungs, and prevented osteoporosis and improved diabetes mellitus [16-19].

With regards to Buah Merah oil, there are various empirical reports of improvement for stamina, hypertension, gout, allergy, eczema, cancers, hepatitis, AIDS/HIVs, hair-growth, constipation, lower body temperature and so on, but the effects of Buah Merah oil have not been established [5, 6, 13, 20-22].

In Japan, it has been reported that Buah Merah oil inhibited proliferation of cancer cells such as S-180, Lewis lung cancer, human non-small lung cancer A549 and human gastric cancer K-MK-6 cell lines in mice [23, 24]. When Buah Merah oil was given to SHR-SP rats, it increased in longevity of SHR-SP rats by 20 % [25]. In vitro studies using melanoma cell B16 line revealed that Buah Merah oil was not cytotoxic until the concentrations of 400 µg/mL and suppressed melanogenesis and tyrosinase activity in a dose-dependent manner [26]. It is suggested from an additional study that suppression of melanogenesis is probably associated with stimulated degradation of tyrosinase through ubiquitin-proteasome system [27].

Beta-cryptoxanthin suppresses the growth of human non-small-cell lung cancer cells, A549 cells in vitro by approximate 50% at concentration of 20 µmol/L [28]. In contrast, 500 µg/mL (equivalent to 0.05 µmol/L of beta-cryptoxanthin) of Buah Merah oil suppresses the growth of A549 cancer cells by 97.5% [23]. These findings indicate that Buah Merah oil has more than 400-fold stronger action in suppression of A549 cell growth as long as beta-cryptoxanthin levels are concerned.

We speculate that Buah Merah oil may exert suppression of cancer cell growth not only by beta-cryptoxanthin’s action but also by synergic effects with unknown ingredients, probably other carotenoids.

Buah Merah products are categorized as traditional herbal medicine in Indonesia. Indonesian Buah Merah products claim the benefits or efficacies for cancers, stroke and hypertension, gout, diabetes mellitus,
Osteoporosis, eye disorders, improvement of intelligence and infertile.

On the other hand, Buah Merah products are classified as dietary food in Japan and Korea, therefore they are claimed for use of dietary food to intake natural micronutrients and fruit oil.

CONCLUSIONS

Buah Merah is Papua-originated rare and unique plant and fruit that has been providing functional and essential micronutrients such as provitamin A carotenoids and vitamin E as well as fruit flesh oil to Papuan native folks living at highland areas under poor environments for more than 30,000 years.

Buah Merah is likely to provide various actions for human health in related to rich contents of provitamin A carotenoids, especially beta-cryptoxanthin. Beta-cryptoxanthin may exert synergic actions with other carotenoids or unknown ingredients.

The long history and experiences of use of Buah Merah by Papuan people proves the strong evidence of safety. There are no adverse events reported in Indonesia, Japan and the other countries in human use. In addition, the toxicity studies of Buah Merah oil do not reveal any toxic findings caused by Buah Merah oil.

There is no reason to limit consumption of Buah Merah oil because Buah Merah oil is pure dietary food derived from Buah Merah fruit. However, daily acceptable highest dose of Buah Merah oil may be 10 g/day from dietary custom of native Papuan people.

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