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Albertisia papuana Becc. An INDIGENOUS PLANT OF INDONESIA, PROSPECTIVE AS A FOOD AND MEDICINE INGREDIENTS, A REVIEW

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ABSTRACT

The purpose of this review is to examine the use of *Albertisia papuana* Becc. for food and its therapeutic effects as anticancer, antimalarial, antimicrobial. The method used is various articles that are relevant to the topic of electronic data. Results show *Albertisia papuana* Becc. containing umami compounds (glutamic, aspartic, IMP, GMP, AMP) which contribute to improve food flavor while butyric, linolenic acid, stigmasterol, beta/gamma tocopherol, squalene and 3,4-dihydro-6,7-dimethoxy isoquinoline 2- oxide has a contribution as an anticancer, alkaloid cocsoline, isotrilobine as an antimalarial agent and alkaloids daphnandrine, daphnoline can fight Leishmania and Trypanosoma. There is a strong relationship between polar and 5-nucleotide amino acids with umami, lipids (short chain fatty acids and saturated polymers, sterols, tocopherols), alkaloid BBIQ, squalene and gallic acid against cancer, malaria and microbial cells. Based on the results of the study, it is recommended that the use of *Albertisia papuana* Becc. expected to contribute to use in the food industry so as to maintain food security and the pharmaceutical industry to reduce disease and help protect or treat infections in humans. This is important to explain that this plant is very potential to be developed so that people can benefit from local wisdom for the benefit of mankind.

Keywords: *Albertisia papuana* Becc., BBIQ alkaloids, gallic acid, umami

ABSTRAK

Penulisan review ini bertujuan untuk mengkaji penggunaan Albertisia papuana Becc*. untuk pangan dan efek terapinya sebagai antikanker, antimalaria, antimikroba. Metode yang digunakan yaitu berbagai artikel yang relevan dengan topik berbasis data elektronik. Hasil memperlihatkan Albertisia papuana* Becc*. mengandung senyawa umami (glutamic, aspartic, IMP, GMP, AMP) yang memberikan kontribusi untuk meningkatkan flavor pangan sedangkan asam butirat, linolenat, stigmasterol, beta/gamma tokoferol, squalene dan 3,4-dihydro-6,7-dimethoxy isoquinoline 2-oxide mempunyai kontribusi sebagai antikanker, alkaloid cocsoline dan isotrilobine sebagai agen antimalaria, sedangkan alkaloid daphnandrine, daphnoline dapat melawan Leishmania and Trypanosoma. Terdapat hubungan yang kuat antara asam amino polar dan 5'-nukleotida dengan umami, lipid (asam lemak rantai pendek dan politak jenuh, sterol, tokoferol), BBIQ alkaloid, squalene dan asam galat dalam melawan sel kanker, malaria dan mikroba. Berdasarkan hasil kajian, disarankan bahwa penggunaan Albertisia papuana* Becc*. diharapkan dapat memberi kontribusi untuk*

digunakan pada industri pangan sehingga dapat menjaga ketahanan pangan dan industri farmasi untuk mengurangi penyakit dan membantu melindungi atau mengobati infeksi pada manusia. Hal ini penting untuk menjelaskan bahwa tumbuhan ini sangat potensial untuk dikembangkan sehingga masyarakat dapat mengambil manfaat kearifan lokal bagi kepentingan umat manusia.

Kata kunci: *Albertisia papuana* Becc., *alkaloid BBIQ, asam galat, umami*

INTRODUCTION

There are many plant species which has been used by tribal and folk communities of forest region of Kalimantan (Indonesia) by The Dayak since the early stages of human, plants play an important role as medicine and food to the human race. Many of the plants that contain nutrition or phytochemicals have reputations as medicine in the folklore of various cultures as a traditional herbal medicine (WHO, 2013), but their pharmacognostical as well as phytopharmacological importance is yet unknown as the plants are rarely available. It has been proposed that the mayor of modern drug developing based on traditional medicine as a wisdom local, especially in tropical countries such as Indonesia.

One of the plants is *Albertisia papuana* Becc., is not much known by others in Indonesia, except The Dayak peoples around of Kalimantan. The community of Dayak used *A. papuana* Becc. as a human food (flavoring; flavor enhancer) and traditional medicine. There is a less research reported or study about *A. papuana* Becc of Kalimantan or other region in Indonesia or outside of the country. *A. papuana* Becc. belonging to Family Menispermaceae, as a wild food plant in Indonesia which have been known contain alkaloid as a phytochemical compounds very good for medicine value. The Menispermaceae as one of important medicinal plants in the world especially containing anticancer properties (Mumtaz et al., 2015). The genus *Albertisia*, 12 spp in tropical and subtropical Africa (*Albertisia delagoensis*, *A. angustifolia*, *A. miersiana*, 5 spp in Indo-Malaysia. Three of 5 spp which in Malaysia as *A. crassa* Forman, *A. megacarpa* Diels. and *A. papuana* Becc. The genus *Albertisia*, 12 spp in tropical and subtropical Africa (5 spp in Indo-Malaysia). Three of 5 spp which in Malaysia as *Albertisia crassa* Forman, *A. megacarpa* Diels. and *A. papuana* Becc. Forman, 1986). There is only one species of *Albertisia papuana* Becc. available in Indonesia especially in Kalimantan and Riau (Purwayantie et al., 2013 and Gillison, 2001), **Fig 1.** Reported by Habli et al. (2017) more than 17.000 alkaloids from 27.000 different alkaloids, have displayed diversified pharmacological properties especially anticancer activities. Alkaloids sub class which are the most studied and published were benzylisoquinoline alkaloids (BIAs), because the sub class reported by Ghirga et al. (2017) as secondary metabolites exhibit biological activities and has been shown to be benefical to pharmacy. In

derivative of BIAs such as BisBenzylIsoQuinoline (BBIQ) alkaloids of Menispermaceae has shown as anticancer, antiplasmodial or antimalarial and antiamoebic (Marshall et al. 1994 and Frappier et al. 1996). The plant parts used were the leaves for food flavoring, bark and the roots for traditional medicine.

Drugs and food-based local wisdom development today, is in great demand by the industry and the world community oriented healthy because of the natural. It must be acknowledge (reference or cite) any work or part of any work for the Indonesian itself if we want to move forward. Back to nature or local wisdom based philosophy, are still a very selling concept in the future or in the 2050 global food trends. One solutions in drug and food development can be used ethnobotanical bioprospecting approach. These approach almost used to find a new cancer drug (Kashani et al 2012).

The problems exactly could be solved with the governments and the communities self to managed and developed local plants in local wisdom perspective which in twenty past years decades has been concern by global communities by natural drug or natural food. Unfortunetly, some of local governments, and or local communities are not interested or they don't know how to development or explain to publish to the world or even closed from the world. The solved could be done if the central governments, Indonesian peoples and the world communities together develop and publish such as by research.

The present review includes detailed phytochemical investigation and therapeutic importance of the plants. *A. papuana* Becc. has very good for food flavorings and good medicinal potential which can be further explored for advance research and preparation of formulations. Hence, it has turn out to be very important to review on *A. papuana* Becc., it can be a play important role in research on plant to find their possible new medicinal importance and new food ingredients.

MATERIALS AND METHODS

Materials

a. Research/Review articles
b. Books
c. Thesis/Dissertation

Methods

To obtain a maximum number of eligible articles, the search terms *A. papuana* Becc. was separately integrated with the four interesting outcomes: "nutrition (umami compounds) and food application", "gallic acid and production gallic acid by tannase", "BBIQ alkaloids

activities and anticancer, antimalarial, antimicrobial". We considered studies conducted in any part of the world beetwen 1990-2018. Next step: data extraction and data synthesis.

RESULTS AND DISCUSSION

Nutrition

Based on the local wisdom of Dayak people, it has been done research to proving chemical compounds that contribute to the flavor enhancer from *A. papuana Becc*. leaves. Described by Purwayantie et al. (2013a) and Purwayantie et al. (2013b), that leaves are rich in protein content and contain glutamic acid, aspartic, GMP (Guanosine Monophosphate), IMP (Inosine Monophosphate) and AMP (Adenosine Monophosphate). The polar amino acids and 5'-nucleotides were extracted by buffer phosphate and aquades. Five compounds are known responsible for umami taste (Zhang et al. 2013) which normally has savoury, palatable, and deliciousness.

Umami is taste perceived sensation stimuli by many amino acid mainly by glutamate or aspartate and 5'-nucleotides. Glutamate as a flavor enhancer in the form of glutamate salts Ghirri and Bignetti. (2012). As previously reported, mixed of glutamate and aspartate (MSG-like), produce a lower umami taste sensation than MSG, but strong umami flavor can synergistically enhance by 5'-nucleotides (ex: IMP and GMP) (Zhang et al., 2008). Describe by Kurihara (2015) there is a synergism between glutamate and the 5′-nucleotides. In human, the response to the mixture is about 8 times larger than that to glutamate alone. Therefore, a key feature of umami taste is the synergistic enhancement of potency when polar amino acids is combined with 5'-nucleotides (Chaudhari et al., 2009). Umami taste only exists when available in free amino acid form, did not when they are bound to proteins Kurihara (2015). Interestingly, decribes by Verhagen et al. (2001) who reported that gallic acid could inducing sweetness of umami perception.

In *A. papuana* Becc. leaves, the free aspartic acid higher than glutamic when extracted in phosphate buffer and aquades (Purwayantie et al., 2013a). In Tris-HCL buffer pH of 8 does not detection of glutamic acid (Purwayantie et al., 2015). The total umami is calculated as the equivalent umami concentration (EUC) generated high in the phosphate buffer 8 in 3 minutes (48.31%), meanwhile free glutamic acid and aspartic acid concentration higher in pH of 5 than pH of 6-8. Describe by Nelson and Cox (2004) the pKa of glutamic and aspartic acid at pH of 2.19; 4.25; 9.67 and 1.88; 3.65; 9.60. Then, the more the extraction was done near at the pH of pKa, the higher of the compounds result is obtained. Compared with the umami compounds, other amino acid such as tyrosine is the highest detected from water extract (Purwayantie et al. 2013b). The higher of tyrosine concentrations could be related to

the content of the BisbenzylIsoQuinolin (BBIQ) alkaloids in *A. papuana* Becc., since BBIQ is a derivative of the isoquinolin alkaloids with tyrosine precursors.

Food Aplication

Some investigated has been done how to application and the concentration of the leaves of *A. papuana* Becc. in food. Mayasari et al. (2017a) has been tested the perception of umami from *A. papuana* Becc. with NaCl. Added NaCl to food as resolving power (Dubbleman et al., 2011), its mean that NaCl as a medium to faster interaction between umami compounds with umami receptor to faster released of umami taste. In Mayasari et al. (2017a), the sensory test is done with 15 half-trained panelist (student) by hedonic method. The result showed that in concentration 0.6% NaCl give the higher hedonic. Similarly, recent studies by Purwayantie et al. (2015) has been test the palability of *A. papuana* Becc. leaves extract which in concentration NaCl in 0.25% were detected by trained panelist (from Quality Control Departement of MSG Manufacture, Sidoarjo, East of Java, Indonesia) by using scoring method. The panelist has a certificate of warranty, so that sensitivity of panelists were very important. In the same year, Mayasari et al. (2017b) has been developed product based of *A. papuana* Becc. leaves extract to flavor enhancer instant (powder). The additive were maltodextrin and the concentration NaCl is used still 0.6%. The result showed that flavor enhancer instant which the higher hedonic value was 0.6% with 15% maltodextrin. Furthermore, Mayasari et al. (2018) continued to developed product based of *A.papuana* Becc. leaves extract to functional foods. The product form was nanoencapsulation which the wall material were maltodextrin and chitosan. The combination showed that the smaller particles the smaller gallic acid content but the properties and spherical shape by SEM revealed 3.54 nm ± 1.04 and 8.11 nm ± 1.36. Quantification of phytochemicals as a total phenolic (as gallic acid) used in Folin Ciocalteu reagent as equivalent gallic acid (mg GAE/g) (Khoddami et al., 2013). This methods actually represented of total simple phenolics, based on the presence of gallic acid in leaves extract of *A. papuana* Becc. by HPLC which describe in Purwayantie et al. (2013b).

Generally, glutamic acid as a MSG is ingredient of many industry especially on canned foods (Methven, 2012; Ivanov et al. 2013).

PHYTOCHEMICAL "Simple Phenolic Compound (gallic acid) and Tannin"

Generally, it should be distinguished the term of phenolic and polyphenols which is a complex, meanwhile the phenolics is the simple phenolics such as phenolic acid (C6-C1). Phenolic acids are usually present in the bound soluble from conjugated with sugar or organic acids and tipically components of complex such as hydrolyzable tannin (Latanzio,

2013). Based on structural diversity of the phenolic groups, a large wide range of phenolic compounds in plant, one of them is hydroxybenzoic acid class (Anantharaju et al., 2016) which as the same as hydrolyzable tannin. Reported by Purwayantie et al. (2013b) that *A. papuana* Becc. leaves has detection a compound which phenolic acid as free gallic acid (by HPLC) in water extract with lower concentration (55.95 mmol/L ≈ 0.95%; MW of C7H6O5 170.12 g/mol). The concentration is lower than umami compounds (48.31%).

Gallic acid commonly used in the pharmaceutical industry. Recently years, gallic acid has been showed activities as antioxidant (Oyagbemi et al., 2016; Naksaruya et al., 2015 and Abarikwu et al., 2015), antibacterial (Wang et al., 2017; Rattanata et al., 2016; Barcello et al., 2014; Moreno-Alvarez et al., 2010), anticancer (Rosman et al., 2018; Sourani et al., 2015; Ho et al., 2014; Devi et al., 2014; Zhao et al., 2013; Mitta et al., 2013; You et al., 2010; Chen et al., 2009), antivirus (You et al., 2018; Govea-salas et al., 2016; Hsu et al., 2015), antiplasmodial activity (Arsianti et al., 2017; Aldulaimi et al., 2017; Barliana et al., 2014). It has been explained in Rice-Evans et al. (1996) that in phenolic acids show the higher degree of hydroxylation the higher of antioxidant activity, as is the case of gallic acid. Furthermore, the effect of gallic acid in rats on dementia type of Alzheimer disease had been test by Hajipour et al. (2016). According to Anantharaju et al. (2016), the key of gallic acid important exhibit cancer because the compound have the aromatic ring, number and position of free hydroxyl groups and unsaturated fatty acid chain. Compounds with more number of hydroxylic groups exhibited better anticancer activity compared to the ones with no hydroxylic groups or compounds with –OCH3 moieties. The higher hydroxyl groups the higher potential candidates for preventing the cancer cell proliferation.

Zainal (2016) reported that *A. papuana* Becc. leaves, roots, stems contains of tannin. Based on from Bate-Smith and Swain in 1962, Latanzio (2013) describe definition tannin as water soluble phenolic compounds having molecular weight between 500 and 3,000 g/mol, they have ability to precipitate alkaloids, gelatin and other proteins. In plants, tannins consist of three major groups of metabolites: the hydrolyzable tannins, condensed tannins also phlorotannins which isolated in algae. Tannins is composed of ester glucose with gallic acid, namely gallotannins, so that the hydrolysis which release gallic acids. Methods of tannins degradation by acids, alkalin or hydrolytic enzyme by tannase in some cases (Latanzio, 2013). Banarjee et al. (2017) described that gallic acid productions with tannase, now has been industry choice. Tannase is an enzyme produce by microbe as *Aspergillus niger* (Umarkumar et al. 2012), *Bacillus massiliensis* (Belur et al. 2011) which has been used to hydrolysis tannin to gallic acid. Most of industry, to produce gallic acid of *Terminalia chebula*, *Chebulic myrobalan* and *Emblic myrobalan*, testa of *Anacardiace occidentalis* using tannase (Nallabili et al. 2016; Umarkumar et al. 2012; Belur et al. 2011). According Rodriguez-Duran

et al. (2013), tannase is an enzyme with important application in science and technology, although high cost for the production.

There has been hydrolyzed of *A. papuana* Becc. leaves with tannase to gallic acid by Purwayantie et al. (2018). Most of tannase activity have optimal temperature between 30^{o}C and 40^{o}C (Aguilar et al. 2007), but in some cases there are some information result reported optimal activity at 70^{o}C or 20-25^{o}C (Battestin et al. 2007; Kasieczka-Burnecka et al. 2007). The optimum pH of tannase showed their maximum activity at acid pH value 4.3-6.5, but in some cases as like as the temperature optimum, there are optimal activity at pH of 2 or pH of 8 (Beena et al. 2010; Iwamoto et al. 2008). Hydrolysis of the leaves condition occurring at pH 5-6 and temperature 30-50^{o}C.The result research showed that the higher total phenolic (mg GAE/g) from hydrolysis condition at temperature 35^{o}C and pH of 5.

Reported by USDA (2008) that prediction in US bio-based product industry of gallic acid and pyrogallol as two of specialty chemicals have a market potential in 2025 are 170 ton/year and 200 ton/year. The reported also writing that the source of gallic acid from insects, but in India production gallic acid from plant (gallnuts; myrobalan). We agree with the article of Nayeem et al. (2016) that gallic acid a promising lead molecule for drug development.

Alkaloid

Recently years, has been known that the alkaloids compound having a posess to antibacterial, antibiotic-enhancing, antivirus activities (Seca et al. 2018; Habli et al. 2017; Cushnie et al. 2014). There are eight classification of alkaloids based on their skeleton and one of them is isoquinoline class. The most widely studied of alkaloids in Menispermaceae is isoquinoline alkaloids with precursor tyrosine amino acid (Iriti ad Faoro, 2009). Menispermaceae have produce no less than 122 different alkaloids. BisBenzylIsoquinoline (BBIQ) alkaloids groups the most prodigious source of the groups are from Menispermaceae. Classes of BBIQ alkaloids are a large class of medicinally active alkaloids whose properties are vary (**Table 1)**. Reported by Marshall et al.(1994), BBIQ has two isoquinoline moieties linked to two benzyl moieties. Marella et al. (2012) describe which quinoline ring has been found to possess antimalarial, anti-bacterial, antifungal, anthelmintic, cardiotonic, anticonvulsant, anti-inflammatory, and analgesic activity. The alkaloids composed in *A. papuana* Becc. (BBIQ) was describe by Pelletier (1999) and having 18 different BBIQ alkaloids of the groups (**Table 2**). The roots of *A. papuana* Becc. is found to contain alkaloids (Widyasari, 2012).

Anticancer

Cancer was consider as the second deadliest disease globally (Habli et al. 2017). Maritsa et al. (2015) has been test n-butanol leaves extract of *A. papuana* Becc. against to T47D and MCF-7 breast cancer cells. The result showed that the extract could induce of cytotoxicity. In next year, Kristiani et al. (2016a) test of stems and leaves extract on HeLa cervical cancer and MCF-7 breast cancer again. There are the same result, showed the leaves extract has a very toxic on MCF-7 breast cancer, but the stem extract has a very toxic too on HeLa cervical cancer. In the same year, Kristiani et al. (2016b) was continued test to *A. papuana* Becc. roots against cancer cell line T47D with chloroform and water solvent. The conclusion which the chloroform extract a fairly potent for anticancer activity. The chloroform extract was higher toxic than the water extract, because from GC-MS chromatogram showed that forty six compounds some of which has been known to have cytotoxic activity. It seems ethyl linoleate (49.68%), bicyclo (3.3.1) non-2-ene (29.29%), ethyl palmitate (5.06%) and ethyl heptadecanoate (1.57%) has the higher volatile compounds area respectly.

The water extract of *A. papuana* Becc. saw three compounds and only butanoic acid has cytotoxic activity. These fatty acid includes short chain fatty acid such as butyric acid. The mechanism of butyric acid as anticancer explained in Nudelman et al. (2005) describe that butyric acid elicited the greatest anti proliferative activity, but the nature of the acid had minor impact on proliferation. Finally, Zainal (2016) has been mixed roots, stems and leaves of *A. papuana* Becc. against to T47D in chloroform and methanol solvents. He was conclusion that the mixed extract able to inhibit the cell breast cancer cycles on G0-G1 phase.

Besides, the fatty acids or derivatives, the alkaloids of plants has reported against of cancer cells. In previously study, a synthetic alkaloids has been used by Marshall et al. (1994) to against a cancel cell, some of the alkaloids which composed in *A. papuana* Becc. (daphnoline, aromoline, homoaromoline, cocsoline, cocsuline, isotrilobine). The result showed none of the alkaloids tested showed significant cytotoxic activity against KB cells line of nasopharyngeal carcinoma which the standard use in podophyllotoxin. In fact in 2017, the alkaloids from roots of *A. papuana* Becc. could be against of breast cancer cell T47D. Kristiani (2017) found that the mixed of alkaloids (indoles, quinoline-7-ethyl and 3,4-dihydro-6,7-dimethoxy isoquinoline 2-oxide) with the other phytochemicals (seems part of lipids; stigmasterol, alpha sitosterol, beta/gamma-tocoherol and antioxidant; squalene) against of cancer cell. Generally, just one of the lipids; stigmasterol have been reported having anticancer (Ali et al. 2015), meanwhile squalene and beta/gamma tocopherol were antioxidant (Huang et al 2009, Engin, 2009) and beta-sitosterol was anticancer (Grattan et al. 2013). According to Ali et al. (2015), antioxidant and anticancer has a strong connection in body because antioxidants are considered to be the first line of defense against oxidative

stress, which suggests their usefulness in reducing the risk of oxidative damage during carcinogenesis. So that the anticancer of stigmasterol may be due its induce antioxidant enzyme and antigenotoxic properties.

Antimalarial

Angerhover et al. (1999) has been test BBIQ isolates of *A. papuana* Becc. for antimalarial (antiplasmodial) activity against chloroquine-sensitive and chloroquine-resistant clones of *Plasmodium falciparum*. The alkaloids class show exhibited a wide range of biological potencies in antiplasmodial assays, e.g., isotrilobine. Reported by Marshall et al. (1994), the importance alkaloids for antiplasmodial activity is the status of the nitrogen atoms. Isotrilobine has D ring-saturated, N-2'-methylated analog with trigilletimine, but the most active antiplasmodial activity isolotribine higher than trigilletimine. Meanwhile, their phenols and methyl ester indicated that may result in less active, e.g. cocsuline less active than isotrilobine. In contrast, daphnoline is the higher antiplasmodial activity than the other BBIQ type, that could be phenolic substituents result in an increase in activity, e.g. daphnoline > aromoline > homoaromoline and daphnoline > cocsoline. The standar used in cloroquine diphosphate. The research continued by Frappier et al. (1996) which cocsoline isolated from *A. papuana* Becc. showed the most potent antimalarial agent than BBIQ alkaloids from Annonaceae (monterine and cordobimine, O-methyl dauricine, dauricoline, popisonine, lindoldhamine).

Lusiana et al. (2009) and Lusiana et al. (2013) has been investigation to antiplasmodium against alkaloids of *A. papuana* Becc. used in n-hexana and ethanol extraction. The result showed that, in concentration 10 µg/mL could against parasite of *P. falciparum*. In previous was describe by Kristiani et al. (2013b), that chloroform extract of *A. papuana* Becc. is composed by fatty acids which could be contribution againts the cancer cells. The hexane extract is composed by palmitate, linoleic and linolenic acid.

Antimicrobial

Type of microbes which reported could infect both animals and humans was protozoa of parasites of Leishmania and Trypanosoma genus. It could be decreasing with threatens by alkaloids. At least four of BBIQ alkaloids (aromoline, dephnandrine, dapholine and cocsoline) were reported having a potential to against of leishmaniasis or trypanosomiasis. Reported by Fournet et al. (2000) aromoline and isotrilobine, are the main constituent in various folk remedies used in the treatment of cutaneous leishmaniasis, malaria and amoebiasis. Camacho et al. (2002) has been reported that one of plants which having the leishmanicidal activity from BBIQ alkaloids such as obtained from *A. papuana* Becc. to treatment of

leishmaniasis. One of BBIQ alkaloids in *A. papuana* Becc. was daphanandrine. It has been reported by Camacho et al. (2002), daphnandrine showed strong activity against three of Leishmania species (braziliensis, amazonensis, donovani) with leishmanicidal activity at nearly 84 µM (IC100). [9] has been test of antiamoebic with BBIQ alkaloids from Sigma, besides anti cytotoxix test and anti plasmodial test such as aromoline. The result show that BBIQ has a potential antiamoebic especially aromoline against *E. histolytica* in vitro which had IC50s 5.05-11.1 µM, the standar used in Metronidazole IC50s 1.57 µM. These compound a quaternary isoquinolinic alkaloid (BBIQ group), is one of the alkaloids with the highest leishmanicidal activity. In another reported by Camacho et al. (2002), aromoline, isotrilobine, daphnoline were the alkaloids has shown in vitro antitrypanosomal activity against *T. brucei* (causing human African trypanosomiasis or African sleeping sickness in man and cattle), each concentration IC50 in 1.48; 1.5 and 1.9 µM. The daphnoline from bark of *A. papuana* Becc. as an inhibitor of trypanothione reductase. In previous study too, Fournet et al. (2000), showed the efficacy some of BBIQ against acute and chronic *Trypanosoma cruzi* which infected to Balb/c mice. The daphnoline alkaloids was suggest useful in the treatment of Chagas' disease than others BBIQ (cepharanthine and beznidazole). Another of BBIQ alkaloids was cocsoline, which Camacho et al. (2002) showed that cocsoline have a less potent to toxicity (IC 50=12.3 µM) towards *Leismania donovani* amistigotes than pentostam, the standard drug (IC 50=9.75 µg SB (V)/M)/ml. The cocsoline from the water and methanol root bark of *Epinetrum villosum* displayed antibacterial and antifungal activities (MIC values of 1000-15.62 and 31.25 µg/ml, respectively) (Otshudi et al. 2005).

DISCUSSION

By the authors' knowledge, this is the first study to review provides observational evidence to support the importance of *Albertisia papuana* Becc. The limitation study especially to nutrition for food was not very strong, thus very limit information because just two researcher conducted to flavor enhancer, Purwayantie and Mayasari from the same Department of Food Technology in West Kalimantan, Indonesia. It could be happen because not much food researcher were interesting to food source of Dayak Tribe peoples from Borneo. To produce a product seasoning based on *A. papuana* Becc. could be mixed between gallic acid and umami compounds or mixed with others ingredient of seasoning, such as nano product (nanoemulsion or nanoparticle). In phytochemical study, there is no research or result research link to test phenolic compounds especially gallic acid of *A papuana* Becc against to cancer, malarial and microbial. Research topics connected with *Albertisia papuana* Becc., still alkaloids against to cancer and plasmodium test.

Activity anticancer of the plant is could be connection with lipids such as the short and polyunsaturated fatty acid (butyric acid and linoleic acid), stigmasterol, beta/gamma tocopherol and squalene. Research results which link between PUFA especially linoleic acid or derivate with anticancer or antitumor was describe by Siregar et al. (2015); Yang et al. (2013); Lu et al. (2010); Iwamoto et al. (2008); Llor et al. (2003). The role of pure linoleic acid or conjugated linoleic acid in cancer growth is not well understood and still remains to be investigated.

Until now, there is no publication connected with lipids profile in *Albertisia papuana* Becc. The lipids data just available from GCMS of chloroform extracs. In the future research should be done to analyze of lipids profile such as fatty acid, tocopherols or sterols composition and the extracted by n-hexane, because the chloroform solvent and water did not used to fatty acids extract or lipids. Thus, the result relative low and did not saw others fatty acids except butyric and linoleic acid. This is important to re-check again of fatty acid composition in the leaves, roots and stems, respectively. The solubility chloroform less than n-hexane to lipids extract. Based on the previous research finding, in cancer therapy used in *A. papuana* Becc, it should be not reduced lipids from leaves, roots or stems, because almost scientific result saw the higher relationship between some of lipids with anticancer.

Activity antiplasmodium could be contributed from alkaloids (daphnoline, isotrilobine, cocsoline) and linoleic acid, meanwhile activity antimicrobial were contributed from alkaloids (daphnoline, daphnandrine, aromoline, cocsoline) and lipophilic extract. We could be agree with Melariri et al. (2012) and Kumaratilake et al. (1992) who has been test linoleic and or linolenic acid against malaria, so that there are some connection between linoleic acid in A. papuana Becc. against malaria vector too. Hadjiakhoondi et al. (2006) investigated that fatty acid of *Melia azedarach* L. fruits against malaria vector, which the result obtained from hexane extract had LC 50 of 5.5 ppm against the larvae of *Anophles stephensi*. PUFA was the fatty acid which properties antimalarial such as linoleic acid but parasite killing was significantly increased when oxidized forms (Kumaratilake et al., 1997).

Based on the discussion, we suspected that mixed of phytochemicals such as alkaloids (daphnandrine, daphnoline, indole, 3,4-dihydro-6,7-dimethoxy isoquinoline 2-oxide), squalene and fatty acids (butyric acid, linoleic acid, stigmasterol) and phenolic (gallic acid) together contributed to anticancer, antimalarial and antimicrobial. Findings for *A. papuana* Becc., a medicine plant which found in Indonesia, potent to developed to be ingredients in food or drug medicine. This review is important to guiding of researcher who interested in to developed this plants to be a new food product which a functional food. Besides, this article could be used for decision maker to develop local wisdom for industry.

CONCLUSION

In conclusion, the review summarized: There are interesting chemical compounds of *Albertisia papuana* Becc. which usefull were glutamic acid, aspartic acid, IMP, GMP, AMP, gallic acid, linoleic acid, butyric acid, beta/gamma tocopherol, stigmasterol, daphnoline, isotrilobine, cocsoline, 3,4-dihydro-6,7-dimethoxy isoquinoline 2-oxide and squalene. It is an accessible source of umami, anticancer, antimalarial and antimicrobial with considerable health benefits. For human food, it can be enhanced to improve and develop of instant seasonings based on leaves of *A. papuana* Becc. which could mixed with other seasoning ingredient. Additional studies are required experimental data such as nanotechnology application and evaluation of anticancer, antimalarial, antimicrobial efficacy of all phytochemicals. The work of the project describe here will hopefully provide some guidance to funders and researchers in prioritizing their food functional efforts. It can also draw attention to the importance of the interconnection between nutrition compounds and the phytochemicals ability to move beyond the current portofolio of well-characterized and studied targets. It should add to the global discussion on how best to prioritize local wisdom resources, especially an updates food functional is being developed.

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