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Ethnomedicinal Knowledge of Temiar Ethnic Tribe of Lojing Highlands, Kelantan: A source for Nutritional and Antioxidant Potential

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Abstract: Traditional medicinal plants have been consumed and practised by the Orang Asli of Peninsular Malaysia for centuries. Temiar is one of the sub-ethnics under the Orang Asli (Senoi) tribe. The Temiar ethic tribe utilises indigenous plants for treatment of illnesses and general healthcare. Since the indigenous people transmit knowledge orally; their knowledge is comparatively more vulnerable to extinction. Besides, deforestation and conversion of forest land into farms also contributed to loss of habitat of traditional medicine and food plants. Hence, the objectives of this study are to establish a profile of ethnomedicinal knowledge of indigneous plants utilised by the Temiar tribe in Lojing Highlands. Field study was carried out to document the various plants used to treat diseases and their methods of preparation. Antioxidant activity has been carried out by free radical scavenging (DPPH) assay with 95% ethanolic extracts of *Ageratum conyzoides* (*A. conyzoides*) and *Phyllanthus niruri* (*P. niruri*). The inhibition concentrations at IC_{50} for both plant extracts were found to be 29.79 mg/mL and 34.37 mg/mL, respectively. The results were compared to the butylated hydroxytoluence (BHT). The present study successfully documented the indigenous knowledge of medicinal plants usage and identified potentially high value medicinal plants species that can be used for the economic development of the nation. Additionally, the identification of potentially nutritional medicinal plants and vegetables will contribute to a more diversified diet and food security of the Temiar tribe.

Keywords: *Temiar Group, Indigenous Medicinal Plants, Lojing Highlands, Nutritional Value, Antioxidant Activity*

Introduction:

Plants are vital and essential for both biodiversity and providing primary health care to human beings (Saqib et al., 2014). Since centuries, plants provide food, medicine, shelter, dyes, fibers, oils, resins, gums, soaps, waxes, latex, tannins, ceremonial and even spiritual rituals. Generally, the utilizaion of numerous plant resources by different ethnic groups and communities especially indigenous people help to provide data for documenting the indigenous knowledge. Indigenous people are the people originate from any place and settle down with their own life habit and culture withour any outsiders involvements. The people from such places have created their own indigenous knowledge that interconnected the plant sources with the forests. These precious information must be recorded and documented to prevent the loss of knowledge. Ethnobotany is an interdisciplinary by involving knowledge of plants and their ecology in the context of cultural, social and economic significancce.

The evidence exists that plants were used for medicinal purposed 60,000 years ago.The knowledge of medicinal plants were diversified across cultures and countries such as India (Ayurveda), China (Pen T Sao), Egyptian (Ebers Papyrus) and others (Lulekal et al., 2008). Approximately, 40 percent of the drugs used today derived from the plant origin that people have been used for centuries. For example, quinine from Cinchona bark was previously used as anti-malarial drug and was recorded as the first successful use of chemical compound to treat various infectious disease (Achan et al., 2011). Such knowledge evolve by passing from generaion to generation, develop over time, keep changing and continuously adding values to the new discoveries and methods. The indigenous knowledge systems are not only from the cultures they involve but also for scientist attempt to improve the conditions of the rural communities. Currently, the study of medicinal plants and their traditional use in different parts of the world are slowly increasing. In many countries, researchers and scientists reintroduce and recommend the indigenous plants from the indigenous people through transferring the knowledge. From the interaction, the knowledge have been declining as a result of modern medicine, changes in socio-culture, younger generation lack interest to learn the knowledge and changes of habitat.

The nutrition issues and food security are critical problem faced by countryside societies. Owing to several uncertainties comprising rainfall, climate, geography, deforestation, unadvanced technologies, not interested in forestry food and increasing of unhealthy food or junk food that available in the market today. A survey showed that less than 10% indigenous people preferred traditional foods as they have difficulty in searching for the food in the forest rather than purchase directly from the market. This

routine determine if the individual or family able to maintain and sustain the nutritional well-being, malnutrition or succumb. Nowadays, there is rising substiution and consumption of the newly introduced food as compared to the indigenous exotic plant in the composition of diets. Several issues arise stating that because of the increased revenue from the newly cultivated plants, rural population likely to depend and demand on these market crops as a result in price fluctuations in getting nutritional food to meet their daily requirements for example calories, protein, vitamins and minerals.

Other than nutritional matter of the indigenous people, their health care also need a huge concerned as their resettlement are far from the health care centre, clinics and hospital and fully depend on the medicinal plant in the forest. However, their ethnomedicinal knowledge have not been proven scienifically so the probobility of getting in good health conditions is low. Lately, traditional and conventional medicinal have not much attention from the youngster since they are more rely on the western medicine and this lead to obstacle of unable to identify and recognize the medicinal plants, herbs and only little or even no knowledge on remedies at all. Thus, left only the elderly who still practiced using the medicinal knowledge to treat various disease. As a result, a proper and appropriate documentation on ethnobotany of a particular ethnic group must be jot down and further systematic scienific research must be conducted in order to prove the validity of medicinal usage data.

Pos Brooke, Gua Musang is one of the Temiar resettlement in Kelantan state, Malaysia and rich with wide varieties of plants which contains medicinal value. Temiar ethnic was well-known for treating and curing non-infectious and infectious disease including personal health, hypertension, cough, asthma, fever, gastrointestinal disorders, malaria and others. They have been using their own treatment and administration depending on the knowledge from their ancestor to treat ailments using targeted plant. Till date, the research by the former on medicinal plant used by the Jah Hut tribe (Lin, 2005) , Temuan tribe (Ong, 1994), breastfeeding practices and nutritional status of Temuan and Mah Meri tribe (Wan Norlida et al., 2007). Yet, the indigenous knowledge of Temiar ethnic have not been carried out. Hence, the main aim of this research is to document the indigenous knowledge, determine the nutritional value of indigenous plants for food and identify the antioxidant activities of medicinal plants practiced by the Temiar ethnic at Pos Brooke, Gua Musang, Kelantan.

Materials and Methods:

The study was conducted at Pos Brooke (Jedip village), Gua Musang, Kelantan, Malaysia. The latitude recorded was N04°39’42.5’’, longitude was E101°29’31.4’’ and altitude was 702 to 938 meters above sea level.

The ethnobotany survey was carried out through several ways such as face-to-face communication, questionnaires and voluntary participation of the traditional healers and locals. The Malay language of the authors was considered as an added advantage of interviewing the tribal people to obtain indigenous data. Two types of questionnaires were designed, the first questionnaire was to document the ethnobotanical practices including local name, plant parts used, uses of indigenous plant, method of preparation and application and the second questionnaire was to record the details of the respondents for example gender, age, level of education, occupation and experience in learning the indigenous knowledge.

Collection of plant materials:

The collection of plant samples were carried out according to Queensland Herbarium manual (Queensland herbarium, 2013). The plant samples were collected from the field and photograph were taken for better identification. The plant voucher specimens were authenticated at Institute of Bioscience, Universiti Putra Malaysia. Descriptive statistics were used to analyze the information obtained.

Nutritional Analysis:

The nutritional analysis such as total fat, protein content, energy, carbohydrates, vitamin and mineral contents of the indigenous plants were determined based on the standard method of Association of Official Analytical Chemists (AOAC, 2000).

Antioxidant assay:

The selected indigenous medicinal plants were screened for 1,1-diphenyl-2-picrylhydrazyl (DPPH) antioxidant activities (Fidrianny et al., 2013). Briefly, 0.004% DPPH solution were prepared by dissolving 0.012 g of DPPH into 300 mL of ethanol. The stock solution was kept in +4°C until further analysis. 1 mL of 5 different concentrations (6.25, 12.5, 25, 50 and 100 µg/mL) of samples were mixed with 1 mL of DPPH solution in dark for 30 minutes. Butylated Hydroxyltoluene was used to get standard curve for comparison. The absorbance value were recorded at 517 nm spectrophotometrically.

The percentage of DPPH antioxidant scavenging activity (%) were calculated by using this formula
((A0 – A1)/ A0) x 100%

Where A0 was the absorbance of control and A1 was the absorbance of sample. Inhibition concentration at 50% (IC50) was determined via graph by plotting mean percentage of antioxidant against sample concentration.

Results and Discussion:

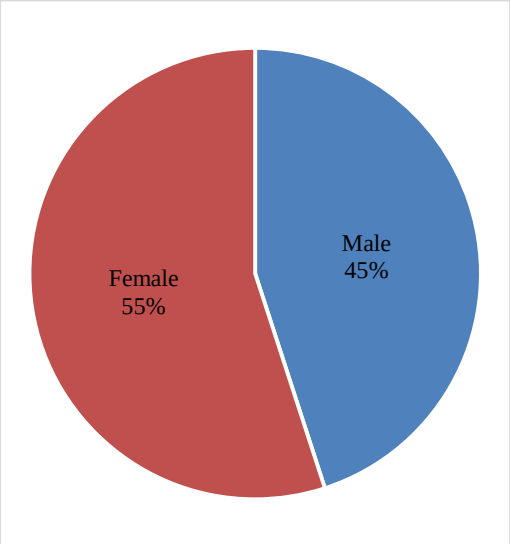

Figure 1.1 The survey of the study with 20 respondents (male - 9 and female -11).

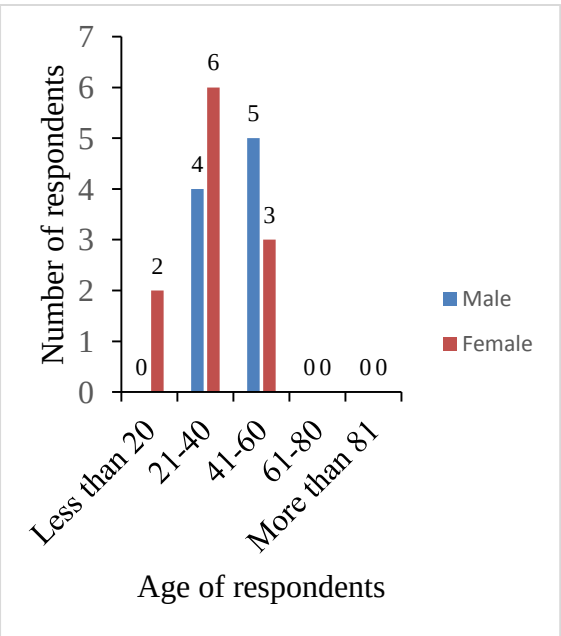

Figure 1.2 Age group of the respondents in the study

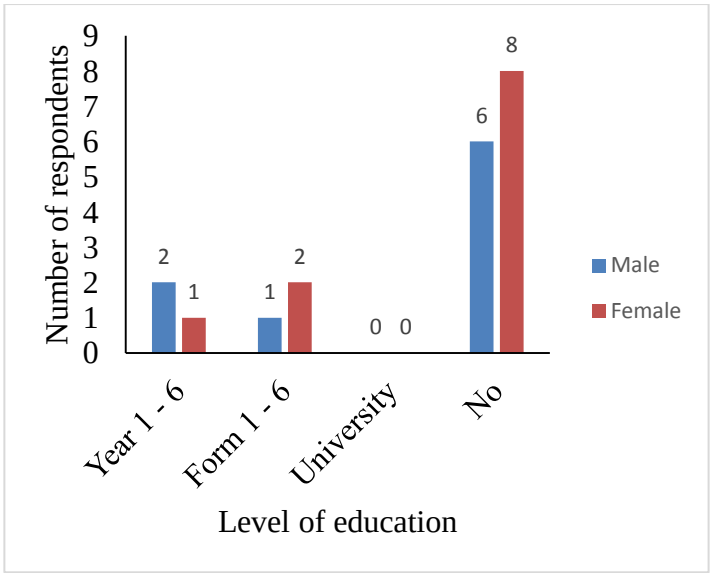

Figure 1.3 The education details of the respondents

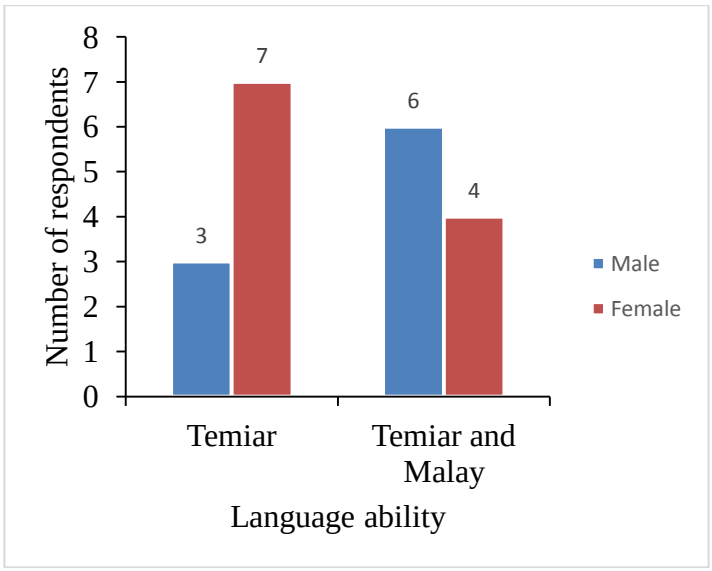

Figure 1.4 The languages used by Temiar group.

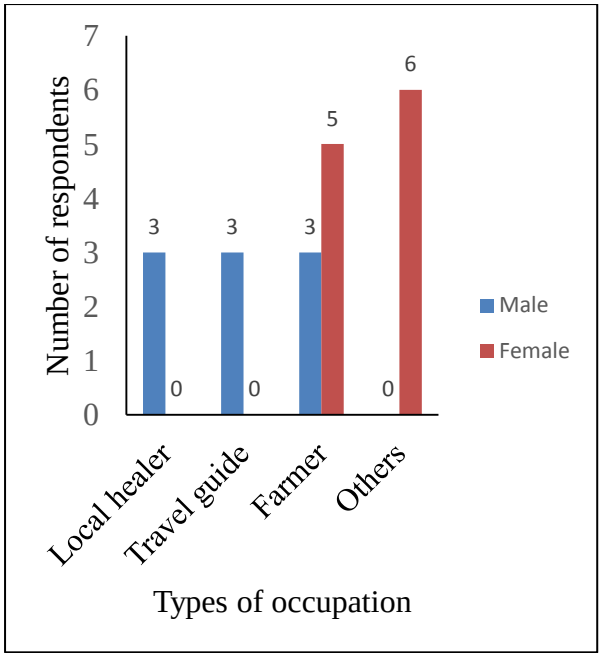

Figure 1.5 Different types of occupation of the respondents

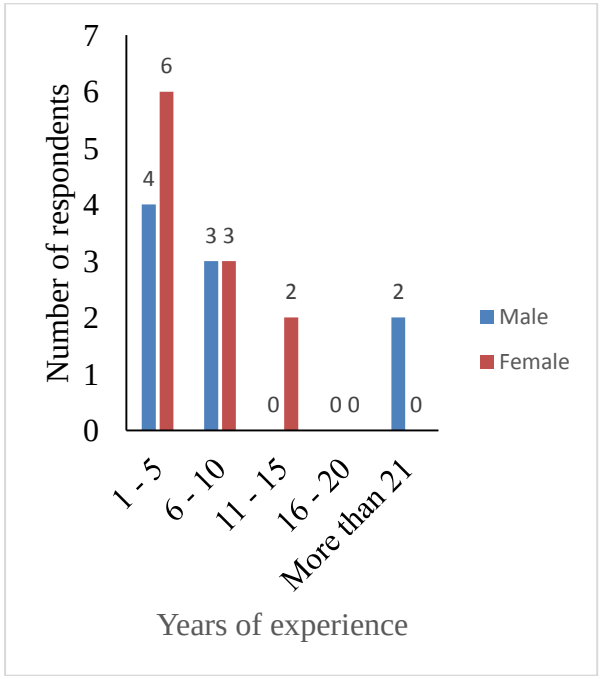

Figure 1.6 Indigenous knowledge were passed down via several generations so they were enthusiastically practiced and utilized in daily live especially the indigenous plants that have medicinal value.

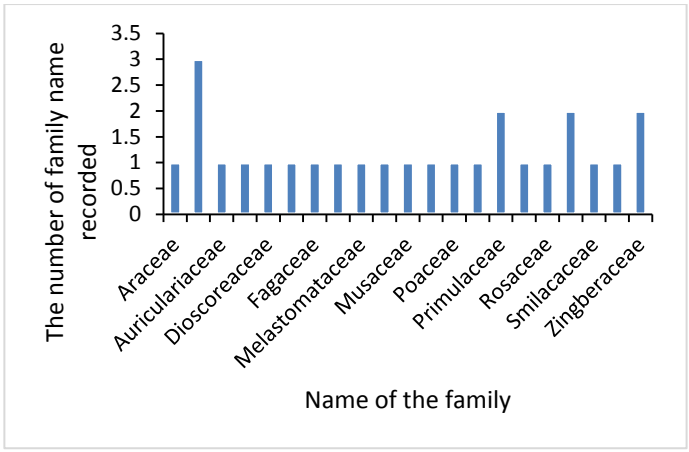

Figure 1.7 The number of plant species according to their family name

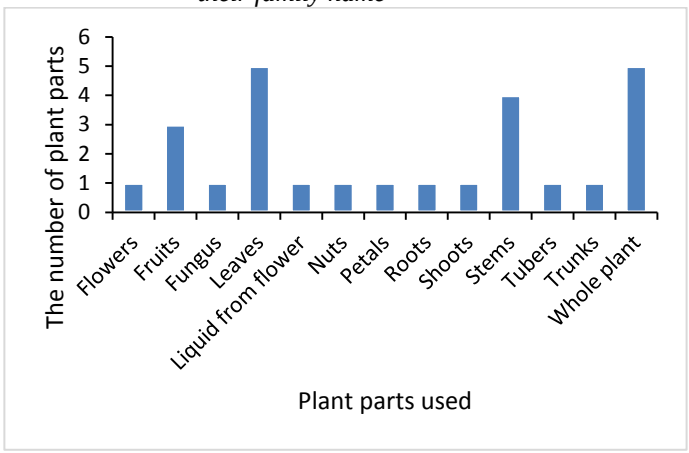

Figure 1.8 The number of plant parts used by the Temiar ethnic group

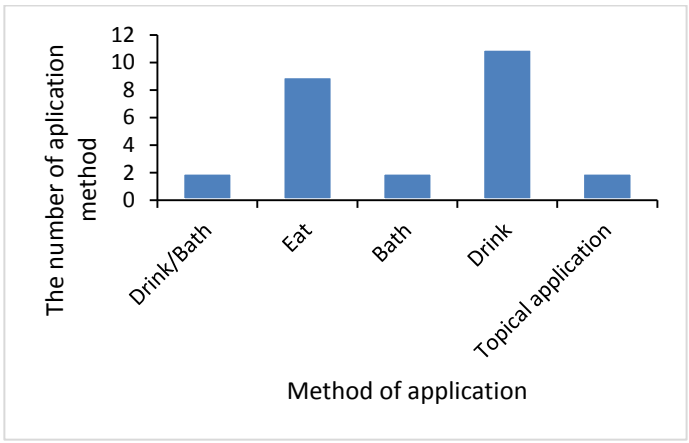

Figure 1.9 The application approaches applied by the Temiar ethnicgroup

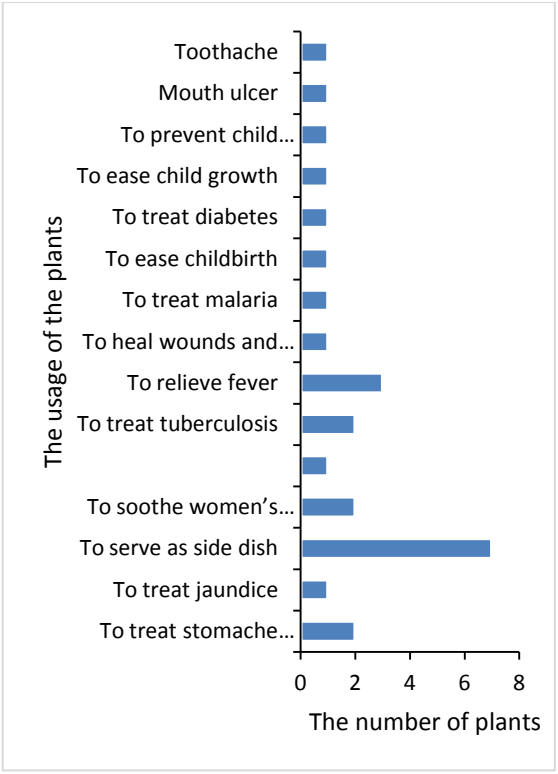

Figure 2.0 The number of plant used to treat particular diseases by the Temiar ethnic

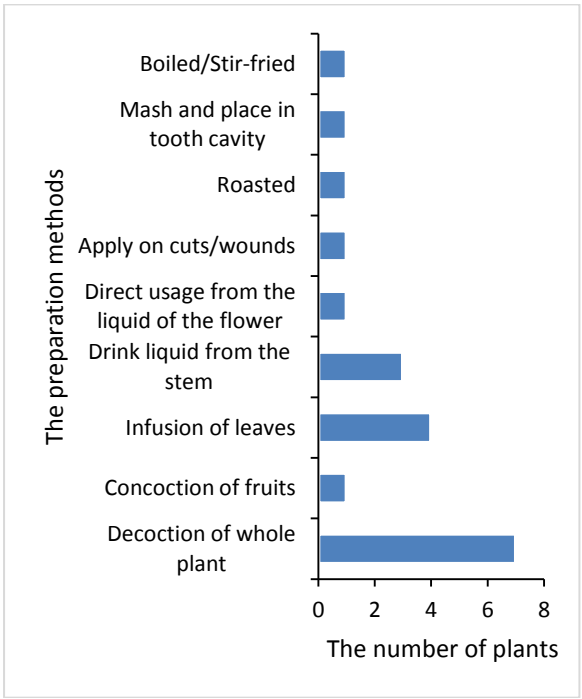

Figure 2.1 Various preparation methods were employed by the Temiar ethnic to cure diseases

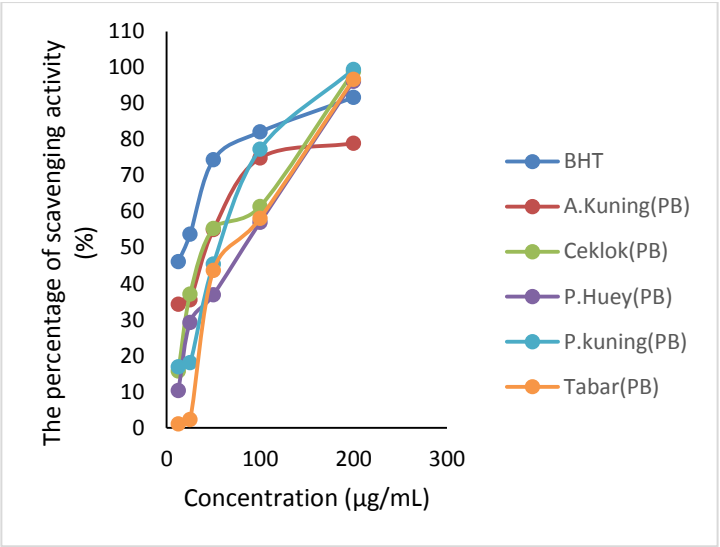

Figure 2.2 The DPPH antioxidant scavenging activity of medicinal plants used as consumption by Temiar ethnic group with five concentration (12.5, 25, 50, 100, 200 µg/mL).

Table 1.2 Nutritional value of indigenous functional plants food consumed by Temiar ethnic group.

Nutritional value	Unit of measurements	Plants for food			
		Cawet	Cewes	Geraloh	Rebung betek
Energy	kcal	346	0	347	23
Carbohydrate	g	70.9	0	83	3
Protein	g	12.1	0.1	3.4	2.2
Total Fat	g	1.6	0	0.2	0.2
Vitamin A	lu/100g	1.8	1.1	3.7	ND< 10
Thiamine (Vitamin B1)	mg/100g	0.7	ND< 0.01	0.5	1.3
Riboflavin (Vitamin B2)	mg/100g	ND< 0.01	ND< 0.01	ND< 0.01	ND< 0.01
Vitamin C	mg/100g	ND< 0.01	ND< 0.01	ND< 0.01	ND< 0.01
Vitamin D3	lu/100g	-	300.4	1063	135.2
Vitamin E	mg/100g	1.6	0.03	0.02	0.03
Vitamin K	mg/100g	ND< 0.1	0.3	ND< 0.1	103.3
Calcium	mg/100g	413.1	7	18.5	12.2
Copper	mg/100g	1.6	0.1	0.5	0.2
Iron	mg/100g	5.3	1.1	2.3	0.8
Magnesium	mg/100g	279.6	1.9	59.7	10.4
Mangan	mg/100g	4	ND<	0.8	0.3

ese			0.05		
Potassium	mg/100g	755	3.6	684.9	361.2
Selenium	mg/100g	ND< 0.05	ND< 0.05	ND< 0.05	ND< 0.05
Sodium	mg/100g	20.8	5	5.8	3.9
Zinc	mg/100g	1.5	0.1	0.5	0.7

An ethnobotanical survey of the Temiar ethnic at Pos Brooke, Gua Musang, Kelantan provided first hand information on traditional knowledge in term of the usage of plants. 20 respondents were interviewed for their medicinal knowledge with age ranging from 21 to 40 years old and they mostly did not receive any formal education as they lived at secluded village which is far from city and unaccessibility of transport. More than 4 people own the indigenous knowledge more than 11 years of experience and lately the younger generation have great interest and attention to learn the knowledges from old folks to prevent the threat of extinction. These knowledge were practices since decades by their ancestors and passed down for every generations.

The parameters of the current study includes respondents in total 20 individuals, their age, education, language, occupation, experience of having indigenous knowledge have been represented in figure 1.1 – 1.6. The total number of plants 21 plants have been identified and documented in the selected site for the research (Fig 1.7). The uses of indigenous plants and different ways of applications have been documented (Figure 1.8, 1.9, 2.0 and 2.1). The antioxidant activity of the selected indigenous plants has been evaluated and represented in figure 2.2. The number of different indigenous plants used by Temiar ethnic group is listed in table 1.1 and the nutritional values of the seleceted indigenous plants are listed in table 1.2

Plants are very good sources for food, pharmaceutical, cosmetic and agrochemicals industries. Continual effort of searching the traditional plants brings great interest and popularity in research due to the unexpensive cost, low toxicity and readily available in the forest. Based on the ethnobotamical survey, the current study documented total of 26 plant species which belong to 21 families. The plants were separated into two categories in accordance with the usage of plants that were plants for food and medicinal plants. 7 plants were consumed as side dish or salads whereas 19 plants species were utilized as medicinal plants. Asteraceae, Primulaceae, Rubiaceae and Zingiberaceae represent one family with various genus and species. These four families represent 36% of the total species recorded in the study area. In the aspect of individual composition, the study area was abundant with Homalomena sagittiflora (Araceae), Ageratum conyzoides (Asteraceae), Poligala paniculata (Polygalaceae) and Solanum torvum (Solanaceae) plant species. Mostly, the plant parts used were leaves and whole plants followed by stems, fruits, flowers, petals, roots, shoots, tubers, trunks,nuts and liquid from the flower. Plants used for treating ailments range from simple stomach ache, children health problem to serious fever. The most frequent method of application were decoction and infusion. Most of the recipes consists of only one plant but many preparations combined several medicianl plant to boost the efficacy of the medicine. The medicinal plants were used both internally and externally such as consume, drink, bath and applied topically to treat and heal the illness. These plants can be considered as alternative food ingredients and remedied besides the modern medicine and the demand was gradually increasing.

The study on dietary diversity of children from Jah Hut, Temuan and Che Wong ethnic were evaluated in the nutritional status (Chua et al., 2012). The study revealed that under nutrition such as underweight and stunting are major crisis among children of Orang Asli and this definitely lead to promotion of traditional and nutritious food to build up a better healthy lifestyles. According to Flyman and Afolayan, 2006, wild vegetables supposed to be reintroducing due to their important roles to form an integral part of traditional agricultural system. *Labisia pumila* used by Temiar ethnic was applied topically on stomach to treat pre and post partum ailment by using the leaves. Lee et al., 2011; Singh et al., 2009 also reported the similar function of the plant used in Malaysia yet they consumed its water extract and other health benefits such as anticancer, anti-inflammatory and antioxidant. *Phyllanthus niruri* was used as bathing purpose to treat malaria in Temiar ethnic whereas in the research reported by Bharat & Kothari, 2011, there were properties of antioxidant and antimicrobial in the plant which can be increased by axillary bud proliferation using nodal segments of mature plants cultivation.

The antioxidant activity of the selected indigenous medicinal plants was also evaluated through DPPH method and the significant activity was found in all the selected plants. Antioxidants are good agents which exist in several parts of the plant materials and serve as biological important molecules. The highest antioxidant activity of the selected indigenous medicinal plants was found to be dose dependant. *P.kuning, Ceklok, P.Huey* and *Tabar* have been found to have significant antioxidant activity with increasing the dose. *A.kuning* found to have least antioxdant activity among the selected indigenous medicinal plants. The polyphenolic compounds may be the responsible agents for the antioxidant activity of the plants.

Conclusion:

In conclusion, the present research on ethnobotany data obtained from Pos Brooke provides preliminary data on the indigenous plants which are being consumed and practiced by the Temiar communities

of the selected area. The documentation also proves that the study sites contain abundant of indigenous plants which may potententially used as the ingredient in food and drugs industry based on the antioxidant properties. The current research offerred a platform of preliminary ethnobotanical data practiced and maintained by Temiar ethnic in Gua Musang, further preservation of these valuable knowledge, enhance the novel food and drug discoveries. To the best of our knowledge, this is the first report about the medicinal values and documentation of medicinal plants used by Temiar Ethnic group.

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S. No	Family	Species Name	Temiar Name	Local Name	Temiar traditional usage	References
1	Araceae	*Homalomena sagittiflora*	Kawok	Kelemoyang, Kemoyang	Decoction of root to treat tuberculosis. Bath	(Wong et al., 2012)
2	Asteraceae	*Ageratum conyzoides*	Belkor	Rumput Tahi Ayam, Goat weed	Decoction of whole plants to treat malaria. Bath	(Sumalatha, 2012)
3		*Erechtites valerianifolia*	Peng hong	Tropical burnweed	Raw eaten to serve as side dish	(Abdul Wahab et al., 2015)
4		*Wedelia biflora*	Suntuk	Butang baju fatimah	Mashed flower were placed in tooth cavity	(Yoganandam, Gowri, & Biswas, 2009)
5	Auriculariaceae	*Auricularia sp*	Bergentok/ Berangit	Cendawan telinga kera, monkey's ear fungus	Fungus raw eaten as salad	(Choudhury & Sarma, 2014)
6	Costaceae	*Cheilocostus speciosus*	Tabar	Malay ginger, Crepe ginger	Infusion of leaves to soothe women's postpartum period. Bath	(Mathur & Joshi, 2013)
7	Dioscoreaceae	*Tacca integrifolia*	Ranyek	Batflower/Arrowroot	Infusion of leaves to treat diabetes. Drink	(Kitjaroennirut, Jansakul, & Sawangchote, 2005)
8	Fabaceae	*Caesalpinia sappan*	Cerwes	Sepang,False sandalwod Sappanwood	Liquid from the stem to treat stomach-ache. Drink	(Sarumathy, Vijayayakanthia, & Dhana Rajan, 2011)
9	Fagaceae	*Castanopsis megacarpa*	Geraloh	Berangan/Tugoh	Roasted nuts serve as salad	(Milow, Malek, Edo, & Ong, 2014)
10	Hypoxidaceae	*Molineria capitulata*	Karyiel	Lemba, Palm grass, Weevil lily	Fruit raw eaten to serve as salad	(Malek et al., 2014)
11	Melastomataceae	*Clidemia hirta*	Cengkarak	Koster's curse, Soap bush	Decoction of stems to treat ulcer in mouth. Drink	(Norhayati et al., 2013)
12	Menispermaceae	*Fibraurea tinctoria*	Akar kuning	Akar kunyit/Sekunyit	Liquid from the stem to treat tuberculosis. Drink	(Keawpradub, Dej-adisai, & Yuenyongsawad, 2005)
13	Musaceae	*Musa gracilis*	Bambis	Pisang hutan/Wild banana	Topically applied the leaves to heal cuts/wounds	(Pereira & Maraschin, 2015)
14	Phyllanthaceae	*Phyllanthus niruri*	Pokok penyakit kuning	Pokok Dukung Anak/Gale of the wind/stone-breaker	Decoction of whole plant to treat jaundice. Drink	(Harish & Shivanandappa, 2006)
15	Polygalaceae	*Poligala paniculata*	Peng huey	Akar Tuju Angin/Island snake-root	Decoction of whole plant to treat stomache pain. Drink	(Lapa et al., 2009)
16	Poaceae	*Dendrocalamus asper*	Rebung betek	Betung, Rough giant bamboo	Shoot was slice into small pieces, Boiled/Stir-fried as side dish	(Nirmala, Ali, & Badal, 2011)
17	Primulaceae	*Labisia pumila*	Kacip fatimah	Kacip Fatimah	Topically applied infusion of leaves to	(Norhaiza, Maziah, &

					treat pre- and post partum treatments.	Hakiman, 2009)
18		*Ardisia sp*	Lemboh	-	Decoction of whole plants to ease child growth. Bath	(Lemaire, Smets, & Dessein, 2011)
19	Rafflesiaceae	*Rafflesia kerrii*	Bunga pakmar	Bunga patma, Devil betel box,stinking corpse lily	Infusion of petal to ease childbirth. Bath	(Kanchanapoom et al., 2007)
20	Rosaceae	*Rubus sorbifolius*	Keber Moi	Berries	Fruit is raw eaten to serve as salad	(Huang & Hu, 2009)
21	Rubiaceae	*Uncaria acidia*	Kadoda	Cat's claw	Liquid from the stem to relieve fever. Drink	(Patil et al., 2012)
22		*Psychotria malayana*	Ceklok	Pecang	Decoction of whole plants to relieve fever. Drink	(Hadi, Rahmawati, Asnawati, Ersalena, & Azwari, 2014)
23	Smilacaceae	*Smilax myosotiflora*	Ubi caring	Ubi jaga, Ubi besi	Raw eaten to serves as aphrodisiac	(Wan, Norliza, & Dasuki, 2013)
24	Solanaceae	*Solanum torvum*	Cawet/Monggoi	Terung pipit	Concoction of fruits serve as salad/side dish	(Jaiswal, 2012)
25	Zingiberaceae	*Zingiber spectabile*	Selinding	Tepus Tanah	Liquid of the flower to relieve fever. Bath	(Viégas et al., 2012)
26		*Elettariopsis curtisis*	Tebak	Tepus wangi	Raw eaten the leaves to prevent child urination at night-time	(Ibrahim et al., 2009)

Table 1.1 Indigenous plants utilized by Temiar ethnic group