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Indigenous Plants and Tuber as Alternative Food Sources for Temiar Communities During Flood Situations

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ABSTRACT
Temiar tribal people are famous for using forest resources as their food and medicinal supply. During the 2014 monsoon flood, affected villagers evacuated to nearby hills to escape the flood and rising river water. Hence, Temiar communities who used to practise the utilization of indigenous plants and tubers were forced to search for alternative food sources during the flood. Hence it is the objective of this paper to determine the types of indigenous plants and tubers used as food sources by the affected villagers. Sampling of plants consumed by the villagers were conducted at selected villagers. Voucher specimens were created and sent for identification. Fourteen types of plants and tuber were identified as alternative food sources by the Temiar communities used during the natural disaster. Plant species include paddy (*Oryza glaberrima*), tuber (*Manihot esculenta*), shrubs (*Solanum torvum, Clidemia hirta*), palm (*Arenga obtusifolia*), herbaceous (*Erechtites valerianifolia, Eryngium foetidum, Pentaphragma begoniifolium*), macrofungus (*Auricularia* sp.) bamboo shoot (*Dendrocalamus asper*), wild fruits (*Castanopsis megacarpa, Molineria capitulata* and *Rubussumatranus*) and water extracted from stem of *Caesalpiniasappan*. Wild local plants were readily available and contributed nutrients and energy to the villagers.The identification of 14 types of food plants and tuber will provide alternative food sources for the Temiar ethnic groups particularly during lack of food availability and accessibility.

KEYWORDS: food security; natural disaster; nutrition; Orang Asli; wild plants

INTRODUCTION

The monsoon flood hit the East Coast of Malaysia in December 2014 and January 2015 and was one of the worst for the past three decades. Over 250,000 people were evacuated and there were 21 deaths. A minimum of 14 orang asli regroupment schemes were affected by the 2014 floodwaters. Accessibility to basic needs (food, medicine and relief centres) were affected as the floodwaters damaged roads and bridges near their villages (The Star, 2015) [1] (Figure 1). The Temiar communities were affected as food aid were slow to reach their villages. This led to reduced food trade (particularly for rice, salt, canned food and sugar) among the communities.

Temiar tribal people are famous for using forest resource as their food and medicine supply (Mohammad and Sharif, 2012) [2]. In Kelantan, forest plants had been used as indigenous food by the locals but are no longer practised by the younger generations. The elderly Temiar communities, village head and medicine man / woman are knowledgeable about the type of edible indigneous plants. During the flood, affected villagers evacuated to nearby hills to escape the flood and rising river water. Hence, Temiar communities who used to practise the utilization of indigenous plants and tubers were forced to search for alternative food sources during

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the flood. During this period, the younger generation and men were no longer adapt in identifying edible plants and tubers. Via this flood disaster, the older generations of the Temiar tribes actively searched for alternative plants and tubers as food. The younger generations of the Temiar communities were re-introduced to the various types of edible, indigenous plants. Besides, traditional plant foods are sources of inexpensive but high quality nutrition for the local community. These plants grow wild and are readily available in the field as they do not require any cultivation (Odhav *et al.*, 2007) [3].

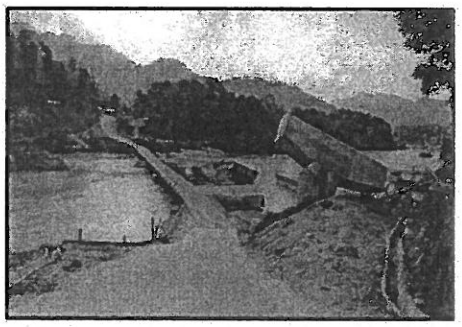


Fig. 1:

Medicinal plants and vegetables that grow wildly are readily available and represent inexpensive sources of high-quality nutritional food for the indigenous community. Vegetables are a rich source of vitamins and contribute to antioxidant activity in the diet [4] (Gupta and Bains 2006). Consumption of a variety of traditional plants will contribute to a diversified diet needed to meet daily micronutrient requirements. Recent studies [3, 5, 6, 7, 8] (Dias *et al.*, 2014;Mutheeswaran*et al.*, 2011; Odhav *et al.*, 2007; Toyang and Verpoorte, 2013; Wang *et al.*, 2014) had stressed on the nutritional value of traditional plants and leafy vegetables. Traditional leafy vegetables were found to contain vitamin A (99 – 1070 µg retinol equivalent), ascorbic acid (2 – 198 mg), riboflavin (0.1 – 0.6 mg) and folate (16 – 457 µg) [9] (Uusiku *et al.*, 2010). Minerals such as iron ranged from 3 – 16.2 mg/100g, zinc (0.7 – 1.0 mg/100g), magnesium, (34.5 – 141 mg/100g) and calcium (151 – 586 mg/100g) [10] (Schonfeldt and Pretorius 2011).

Tuber roots are also good sources of energy while tapioca or cassave leaves provide protein, vitamins and minerals. Tapioca roots can provide up to 150 kcal, 3.5 g protein and 3.7 g fiber /100g. Vitamins such as Vitamin A (5.0 – 35.0 µg), thiamin (0.03-0.28 mg), riboflavin (0.03-0.06 mg), niacin (0.6-1.09) and ascorbic acid (14.9-50 mg) can be found in roots [11, 12] (Charles *et al.*, 2005; Montagnac *et al.* 2009). Tapioca can be found in the wild or grown as food reserve and need not be harvested if domestic food supplies are plentiful [13] (FAO 1990). Temiar households can opt to cultivate root crops as one of the hunger mitigation strategy during flood season.

Nutritious plants and tubers can be utilised as alternative food, especially during flood seasons of due to inaccessible routes. However, in order to ensure the local communities are aware of the types of edible plants and tubers, the plants should be re-introduced to the community – particularly to the young (ages 18 – 35 years) and middle-aged adults (age 36 – 55 years). These two age groups are significant as they play a role in ensuring household food security, contribute to livelihood sustainability of the village decision-making roles. Hence it is the objective of this study to identify potential plants and tuber which can be utilised as alternative food sources during periods of food insecurity or emergency situations.

Methodology:

Identification of sites affected by 2014 floodwaters:

Affected villages (Kg. Jedip, Pos Brook; Kg. Teranek, Kuala Betis and Kg. Gob, Pos Gob) were selected as the main sites of study (Figure 1). There are a total of 2388 Temiar family households in Gua Musang including some Medriq tribes (60 households) in Pos Kuala Lah bordering Gua Musang and Kuala Krai [14] (JAKOA 2014). The villages were selected based on whether their villages were affected by the monsoon flood, accessibility (sedentary areas) and recommendations from Jabatan Kemajuan Orang Asli (JAKOA). Permission to conduct sampling at the selected villages were obtained from JAKOA and village heads.

Sampling of indigenous plants and tubers used as alternative food sources during the flood:

Field trips were conducted at the hill sites where locals collected the plant food they consumed during the flood. All plant species cited for food purposes were collected from the field. Names of local plant food and tubers, their utilized parts and preparation methods were recorded. The following table was used to record the plant information. In depth interviews with the village representatives (head of tribesmen) and medicine men / women were conducted.

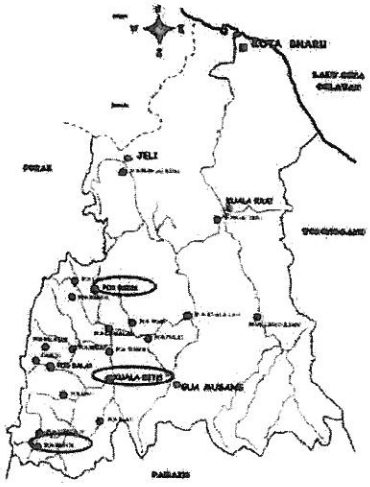


Fig. 2: Selected villages affected by the flood

Herborization:

Samples were dried, and identified taxonomically based on literature. Each herbarium specimen should include important parts such as leaves, stems, flowers and fruits whenever available. For small herbaceous plants, the whole plant should be collected [15] (Semenya and Maroyi 2012). Unidentified plants were sent to Bioscience Institute, Universiti Putra Malaysia for identification and verification.

RESULTS AND DISCUSSION

Identification of indigenous plants and tubers as alternative food sources during flood:

A total of 14 plant samples were identified in all three sites. Local Temiar and Malay names were recorded. Parts used and preparation methods were documented based on the interviews with the village head of tribesman. Table 1 shows the demographic charateristics of the respondent who participated in the in-depth interview while Table 2 reveals the types of plants utilised as alternative food sources.

Some of the indigenous, edible wild plants were also found elsewhere. For example, *Auricularia auricula-judae* (jelly ear fungi) are consumed in the forests of Oaxaca, Mexico [16] (). In Malaysia, macrofungi such as *Auricularia* sp., *Clavulina* sp., *Schizophyllum commune*, *Termitomyces microcarpus* and *Termitomyces* sp. are considered edible by 5 sub-tribes: namely Semai, Temuan, Che Wong, Bateq and Jakun. Based on Lee *et al.* [17], *S. commune* was the most widely consumed fungus but most tribes prefer *Clavulina* sp.

During the flood, the affected villagers were able to access wild fruits growing in the forests. The fruits of *S. torvum* are edible and commonly found in local Malay and Thai cuisines. It is considered an important medicinal plant in tropical and subtropical countries [18]. On the other hand, there has been very little report on the consumption of *C. megacarpa*. A study conducted by Yasuda *et al.* [19] revealed that this prickly fruit is consumed by frugivorous mammals of Malaysia (e.g. leaf monkey, squirrels). Meanwhile, *Rubus sorbifolius* from the *Rosaceae* family are usually eaten raw by the Hmongs [20] and Mien [21] tribes of Thailand. In fact the leaves and stems of *R. sorbifolius* are used to treat severe cough and tuberculosis among the Mien ethnic group. In the Philippines, the Kalanguya tribe uses the extracts of *M. capitulata* as shampoo and body care [22] while the species was used for medicinal purposes in Malaysia [23].

Leaves of *E. valerianifolia* also known as gipun in Sarawak, Malaysia are used as plants for food. [24].Alternative drinking water can be extracted from *C. sappan*, a type of heartwood which is used in Kerala, India as herbal drinking water to quench thirst, purify blood and to improve complexion [25]. A decoction of Sappan heartwood is commonly used to treat arthritis [26] and as a traditional drink or jamu material in Indonesia [27]. Bamboo shoots such as *D. asper* were found to contain high nutritive content such as carbohydrate (2.90 g/100 g), protein (25.80 g/100g dry weight), vitamins C and E (3.20 and 0.91 mg/100 mg fresh weight) [28]. In fact, *D. asper* is reported as one of Thailand's favourite edible shoots [29]. Other wild plants consumed during the flood include*Clidemia hirta*, a type of invasive perennial shrub. The fruits of *Clidemiahirta*are edible and are also consumed in certain parts of Madagascar [30]. Based on Stygeret *al.* [30] studies, the existence of wild fruits represents an important supplement to the daily diet. People usually consume the fruits while traveling through the forest and are collected during shortage of food period. Sayurkelap

(*Pentaphragmabegoniifolium)*consumed in Kuala Betishas been reported as a rare and odd perennial herb that grows in the lowland rainforests of Malaysia [31]. There are limited published reports on this herb.

Table 1: Demographics of village representatives and Tok Batin (medicine men / women).

Demographics	N = 6
Gender	
Male	5
Female	1
Role in village	
Head of tribesman	3
Assistant to head of tribesman	1
Medicine man	1
Medicine woman	1
Others (please state):	0
Villages inundated with water	0
Yes	2
No	0
Connecting roads / bridges affected by floodwaters?	
Yes	4
No	0
Experience difficulty in receiving food aid during the flood?	
Yes	6
No	0
Searched for alternative food sources in the jungle / hills during the flood	
Yes	6
No	0
Total types of wild, indigenous plants consumed during the flood	
Below 3 types	4
4-6 types	
7-9 types	2
More than 9 types	
Did you consume other types of food (besides wild, indigenous plants)?	
Yes	6
No	0
Types of other food consumed	
Rice	6
Canned food	6
Crackers	6
Tea, coffee, milk or beverages	6
Others (please state):	Bread, candies, cooked dishes (at relief centres)
Did you hunt for animals such as squirrels, birds, wild boars or monkeys during the flood?	
Yes	0
No	6

Meanwhile, stems / shoots of *Arengaobtusifolia*are used as traditional food of the Adi tribe in India during droughts and for preparing their local beverages [32]. Alternative food such as cassava (*M. esculenta*) andupland rice(*O. glaberrima*) are essential sources of carbohydrate and provided much needed energy for the villagers during the flood period. The starchy roots of cassava is a well-known major diet in Africa, Asia and South America [33]. Even though upland rice variety produces lower yield, it features good characteristics such as fragrance, size, shape and colour. Additionally upland rice is able to survive on hilly areas with little access to water [34].Eryngium foetidum is a pungently smelling, tropical herb and is used as food, flavouring agent and ethnomedicine [35].

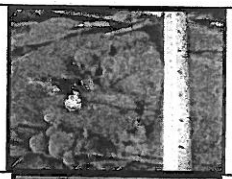
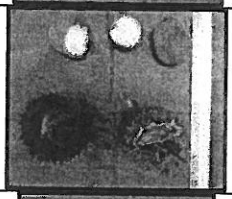
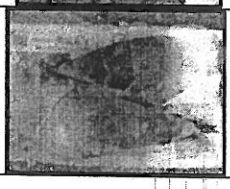
The Temiar communities (i.e. Temiar villages at Pos Brooke) are heavily dependent on rice and are consuming more processed food compared to their ancestors. Additionally, villages situated near to the the main road (Jalan Cameron Highlands-Gua Musang) commonly are able to purchase food items. However, during the flood which wiped out some of the villages connecting bridges and roads, the Temiar communities were affected as food aid were slow to reach their villages. During the flood, the villagers from Kg. Jedip, Pos Brook and Kg. Teranek, Kuala Betis sought for shelter and safety in the nearby hills. Food aid were slow to reach the villages as access to the villagers were inundated by floodwaters. Meanwhile, there were shortage of processed food in Kg. Gob, Pos Gob during the flood. Kg. Gob is situated in the interior of Kelantan jungle bordering with Perak state. Roads were too treacherous (normal dry weather will take 5 hours of travelling in a four wheel drive) and connecting bridges and roads were damaged during the flood as well.

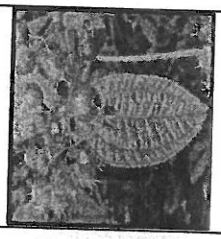
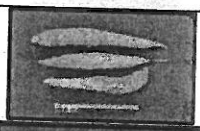
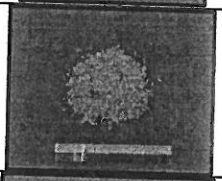
The villagers resorted to harvesting wild, indigenous plants for consumption. In total 14 types of plants and tubers were utilised heavily during the flood and before the villagers were evacuated to relief centres. The head of tribesmen and Tok Batins assisted in identifying the edible plants (i.e. monggoi, betek, kelap), tuber (ubi) and source of clean drinking water (i.e. water from cewes). However, the villagers did not hunt for wild animals during the flood. Based on the in-depth interview, the respondents stated that there were very few sightings of wild animals and they prefer to conserve their energy whilst waiting for evacuation. Additionally, most of the villagers left their blowpipes when seeking higher ground.

During the peak season of the flood (end of December 2014), the villagers depended on the edible, wild plants and tubers to survive. Most of the plants, tubers and rice provided energy and micronutrients for the the villagers. Hence by utilising their local knowledge, the villagers were able to identify wild, edible plants during the flood situation. These indigenous knowledge that are communicated verbally through generations are important. In fact, the villagers ensure their survivability during the flood by correctly identifying edible food

sources for themselves. Indigenous knowledge such as these should be documented to prevent the loss of valuable information.

Table 2: Indigenous plants as alternative food sources during flood season.

Local Name	Species Name	Parts Used	Preparation Method	Photo	Altitude	Latitude and Longitude
Pos Brook						
Bergentok (Temiar); *Kulattelinga* (Malay); Ear fungus (English)	*Auriculariasp.*	Whole fruiting body (note only the brown fungi were identified as alternative food source by the locals)	Harvested and eaten raw.		866 m	04° 39'01.7" N 101°29'43.8" E
Monggoi (Temiar); *Terung pipit* (Malay); Devil's fig, turkey berry, wild eggplant (English)	*Solanumtorvum*	Fruits	Fruits are harvested, sliced and boiled / cooked.		729 m	04° 39.688'N 101°29.274'E
Geraloh (Temiar); *Berangan* (Malay)	*Castanopsismegacarpa*	Fruits	Slice open cupule to reveal brownish nut. Nuts can be boiled / roasted.		922 m	04°39'01.7"N 101°29'43.8"E
KeberMoi (Temiar); Berries (English)	*Rubussumatranus*	Fruits	Mature fruits are harvested and eaten raw.		895 m	04°39'01.7"N 101°29'45.3"E
Karyiel; Catak (Temiar)	*Molineriacapitulata*	Fruits	Fruits are harvested, sliced and boiled / cooked		702 m	04°39'.688"N 101°29'.274"E
Peng Hong (Temiar)	*Erechtitesvalerianifolia*	Leaf	Young leaves are harvested and cooked / boiled.		828 m	04°38.920'N 101°29.881'E
Cerwes (Temiar); Sappanwood (English)	*Caesalpiniasappan*	Stem	Branch / stem is chopped and allow water to drip into container. The water extract can be used as alternative drinking water.		749m	04°39.532'N 101°29.573'E
Rebungbetek (Temiar)	*Dendrocalamusasper*	Shoots	Shoots are cleaned, sliced into small pieces and boiled/stir-fried.		761 m	04°39.497'N 101°29.572'E

Cengkarak(Temiar); Koster's curse, clidemia, soap bush (English)	*Clidemiahirta*	Berries	Fruits are plucked and consumed directly.		891 m	04°38'.664"N 101°30'.029"E
Kuala Betis						
Sayurkelap(Temiar); *Salangsuar* (Malay)	*Pentaphragmabegoniifolium*	Leaves	Leaves are trimmed, washed and cooked.		231	04°53'58.6"N 101°46'45.9"E
Te-ok (Temiar)	*Arengaobtusifolia*	Shoots	Stem is sliced to reveal inner whitish, soft shoot. Shoot should be cooked before consumption.		231	04°53'58.6"N 101°46'45.9"E
Pos Gob						
Ubikayu (Temiar; Malay)	*Manihotesculenta*	Cassava roots	Cassava skin is peeled, washed and roasted / boiled.		490	05°44'45.6"N 101°51'52.2"E
Padihuma / bukit (Temiar) *Padibukit* (Malay); Upland rice (English)	*Oryzaglaberrima*	Grains	Paddy is pound to remove husk, washed and boiled.		485	05°44'45.6"N 101°51'52.2"E
Mong(Temiar) *Pokokpijat* (Malay); Mexican coriander, spirit weed (English)	*Eryngiumfoetidum*	Leaves	Leaves are harvested, mashed and stir-fried.		502	05°16'07.6"N 101°39'10.9"E

Conclusion:

The recent flood had forced the local Temiar communities to search for alternative food sources. A total of 14 types of plants and tuber were utilised by the villagers who took shelter in the jungle/hills. With guidance from the head of tribesman, medicine man/woman and elderly communities, the villagers had correctly identified edible wild plants for consumption. Wild local plants were readily available and contributed nutrients and energy to the villagers. This benefit the younger generation of Temiar communities in identifying wild, edible plants that can be utilised by the villages and contribute to the food and nutritional security of the local Temiar community. Nutritional properties of the plants could reveal potential usefulness of these plants.

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