

Indigenous fruits consumption in Sabah and Sarawak (Penggunaan buah-buahan nadir di Sabah dan Sarawak)

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Keywords: indigenous fruits, consumption, logistic regression

Abstract

Malaysia has a variety of genetic resources and ideal for the cultivation of various types of fruit species. Indigenous fruits are among the lesser-known species although they represent 95% of total fruits species. In 2018, the total crop area of indigenous fruits in Malaysia was 5,900 ha while the total production was 41 mt. Sarawak and Sabah were the largest total producers and crop areas of the fruits contributing to 24% and 54% respectively, in Malaysia. The indigenous fruits were important sources of minerals besides being used as medicinal plants in some areas. However, less attention was given to the fruits due to lack of consumers awareness on their benefits. The main objective of this study was to identify characteristics of consumers of indigenous fruits in Sabah and Sarawak. Data was collected using questionnaires through face to face interviews involving a total of 500 respondents. The locations of study in Sabah and Sarawak included urban areas such as Kuching (n = 125) and Kota Kinabalu (n = 125) and rural areas such as Kota Samarahan (n = 125) and Tawau (n = 125). Logistic regression was applied to determine the factors that explained indigenous fruits consumption. The logistic equation did not directly predict the values of the dependent variables. Instead it predicted the odds of the event of interest occurring. Four independent variables (gender, education level, household income and age) were used to explain the fruits consumption. Age was positively related (B = 0.456) to indigenous fruits consumption and significant at 0.05 level. The value of an odd ratio being more than 1 meant high impact for the consumption of the fruits which was 1.6 [Exp (B) 1.578] times greater for the consumption with one year old increase. The figure showed that the elders were most likely to consume the fruits. However, education level was negatively related (B = 0.380) and significant at 0.1 level. The value of an odd ratio for the education level lower than 1 gave small impact to indigenous fruits consumption and showed that the factor lowered the consumption of the fruits to 31.6% [(Exp (B) 1 – 0.684)]. The data indicated that respondents with lower education consumed more indigenous fruits. Further, R&D is advisable and recommended on nutritional awareness of indigenous fruits to encourage people to consume the fruits and contribute to a healthy society. Attention should be given to minimal processing which has been applied for premium fruits due to change in the lifestyles and small family size. Technology should be enhanced in the diversification of indigenous fruit products to increase the productivity of Small and Medium Industries (SMEs) besides boosting the income of entrepreneurs and providing job opportunities to locals.

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Introduction

Malaysia has an ideal climate for growing various types of fruits estimated to be about 370 species available. Out of this total, 95% was classified as indigenous fruits (Rukayah 1999). Fruits in Malaysia were classified into two categories, namely, premium¹ fruits and indigenous fruits (also known as rare fruits).

Total crop area for fruits in Malaysia showed a decreasing trend from 226,000 ha in 2011 to 194,000 ha in 2016 and then increased to 208,000 ha in 2017. However, it decreased again to 198,000 ha in 2018. *Figure 1* shows the fluctuation in total number of fruit production in Malaysia from 2016 to 2018 and indigenous fruits indicated an increased production from 33,000 mt in 2014 to 43,000 mt in 2016 before decreasing to 42,000 mt in 2018. From 2011 to 2018, the indigenous fruits contributed 2 to 3% of total fruit production in Malaysia.

In 2018, dabai had the largest crop area and leading the total production of indigenous fruits in Malaysia indicating 29% share in land area and 15% share in production. Kuini (15%) and sour soup (8%) also listed the top three largest crop areas. In terms of production, jambu mawar (6%) and kuini (5%) were also leading (*Figure 2*).

Fruit industry in Sabah and Sarawak is quite different compared to Peninsular Malaysia in terms of species. Indigenous fruits that are largely produced in Sabah and Sarawak include bambangan, dabai and tarap [Department of Agriculture (DOA) 2018]. Most of the fruits were grown on a small scale or orchards. In Malaysia, Sarawak and Sabah were the largest producers of the fruits based on the total crop areas which contributed 24% and 54% respectively, in 2018. In fact, the total crop area for indigenous fruits in Sarawak and Sabah showed increasing trends from 2,700 ha in 2014 to 3,200 ha in 2018.

However, Sabah showed slightly increasing trends from 720 ha in 2015 to 730 ha in 2018. Total production in both Sabah and Sarawak increased from 9,800 mt in 2014 to 10,000 mt in 2016, but the production slightly decreased to 9,600 mt in 2018 (*Appendix 1*).

Indigenous fruits are important sources of fibre besides supplying minerals (calcium, magnesium, phosphorous, potassium, sulphur and iron) (Hoe and Siong 1999; Tang et al. 2013; Pearlycia et al. 2013). They are used as medicinal plants which is practiced in some areas. However, less attention has been given to the fruits due to lack of consumers awareness on their benefits. Most indigenous fruits are yet to be explored for their potential as a multipurpose species which can be used as landscape and are also plants that are resistant to diseases and shortens the juvenile period (Erik 2016).

The main objective of this study was to identify consumer's characteristics for indigenous fruits consumption in Sabah and Sarawak.

Methodology

A total of 500 respondents were involved in data collection using structured questionnaires and face to face interviews. The sampling size was focused on populations in Sabah and Sarawak. The respondents were selected by stratified random sampling technique to ensure the subgroups of populations are represented *N* populations. The sample size was divided between the two states, Sabah (*n* = 250) and Sarawak (*n* = 250) including urban (Department of Statistics Malaysia 2015) and rural (Ngah 2010) areas with 250 samples respectively. Kota Kinabalu and Kuching were identified as urban areas to select sample size in Sabah and Sarawak respectively, while rural samples were

¹Nine main fruits were focused under 11MP including papaya, banana, watermelon, starfruit, jackfruit, pineapple, mango, durian and mangosteen

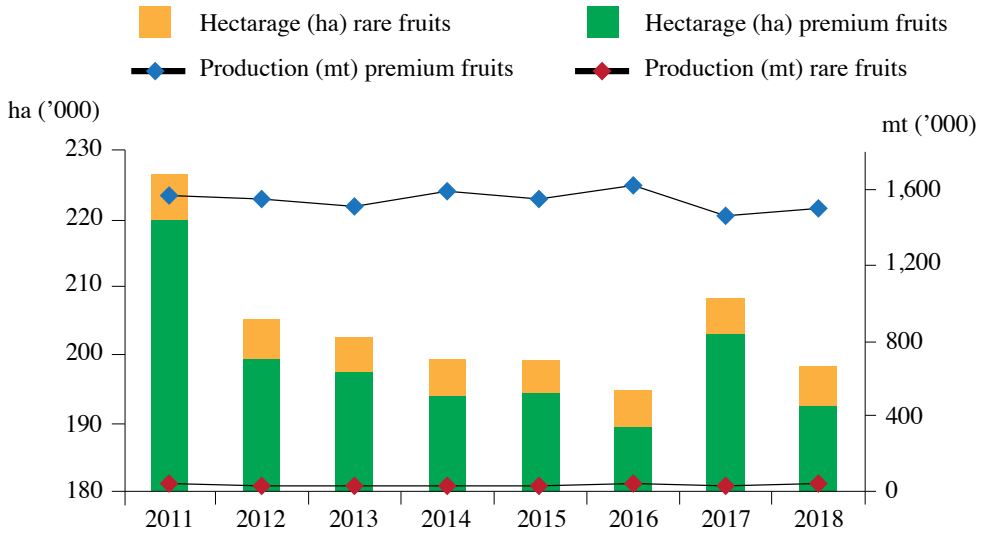


Figure 1. Hectarage and production of fruits in Malaysia ('000), 2011 – 2018
Source: DOA (2018)

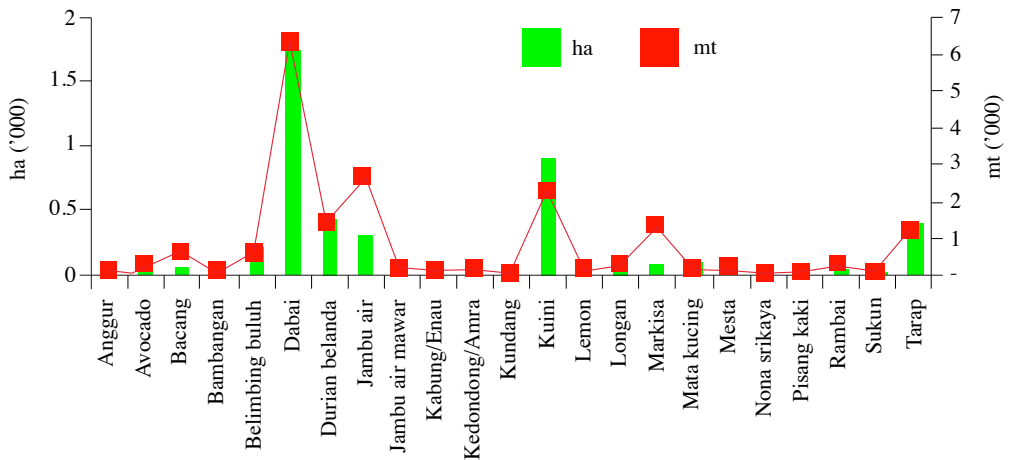


Figure 2. Hectarage and production of indigenous fruits by species in Malaysia (2018)
Source: DOA (2018)

selected from Tawau and Kota Samarahan. The major survey locations included Tamu, the popular market in Sabah and Sarawak, supermarkets and wet markets.

Logistic regression is a widely used statistical technique (Tin 1995) applied to identify the relationships between variables. This method is designed to use a mix of continuous and categorical predictor variables to predict a nominal categorical dependent variable. It does not

directly predict the values of the dependent variables. Instead, the logistic equation predicts the odds of the event of interest occurring. The Dummy logistic regression model was selected for multiple dependent variables (Y) which represents consumption behaviour (“Y = 0” for consume and “Y = 1” for saying no). Logistic regression is a statistical model that in its basic form uses a logistic function to model a binary dependent variable. The dependent variable

(Y) is the consumption of indigenous fruits and the probability of saying 'YES' is one (1) while the probability of saying 'NO' is zero (0). The dependent variables are correlated with the socio-economic factors as shown in the following equation:

$$\ln \frac{\hat{p}}{1-\hat{p}} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \varepsilon$$

where;

b_0 = constant logistic regression

b_n = coefficient logistic x

X_1 = gender

X_2 = education level

X_3 = household income

X_4 = age

SPSS was applied in this study to measure predictive power using pseudo R^2 (Cox- Snell and Nagelkerke) while the Nagelkerke R^2 is a modified Cox-Snell R^2 . The two values are between 0 and 1. The larger the values indicates the more accurate the model. Cox-Snell R^2 value cannot reach 1 and Nagelkerke R^2 was modified to increase the Cox-Snell R^2 to make 1 a possible value for R^2 (Hosmer and Lemeshow 2000; Nagelkerke 1991). Regression coefficients are generally estimated by Maximum Likelihood Estimation (MLE) technique. Maximum Likelihood Estimation is a frequent probabilistic framework that seeks a set of parameters for the model that maximizes a likelihood function and it is usually used as an alternative to non-linear least squares for nonlinear equations. The slope coefficient is interpreted as the rate of change in the log odds as independent variables change. The odds ratio is the probability of the event divided by the probability of the non-event. Odds ratio equal to 1 means that there is a 50/50 chance that the event will occur with a small change in the independent variable. Negative coefficients lead to odds ratios less than one and it tends to be harder to interpret than odds ratios

greater than one (positive coefficients). Gender, education level, household income and age are identified as independent variables for the indigenous fruits consumption model. The explanatory exogenous variables (regressor) used in the logit analysis are classified according to the following general categories: consumer characteristics, managerial factors, physical or location factor, information or institutional factors and awareness or perceptions.

Results and discussion

Major findings were socio economic factors towards indigenous fruits consumption in light with consumption patterns and purchasing behaviour.

Table 1 shows the demographic profile of respondents where 69% of respondents agreed that indigenous fruits are more accessible and marketable in markets (morning market, tamu market, night market, wholesale market and wet market) while the rest thought otherwise. A total of 500 consumers in Sabah and Sarawak indicated that 87% respondents consumed the fruits although they agreed that currently indigenous fruits are less accessible even at the common markets in both Sabah and Sarawak. Seventy percent respondents were at least 35 years old. Approximately, 90% of consumers were either college or high school graduates. Most consumers (90%) received their household income up to RM5,000 per month.

There is still a demand for the fruits in Sabah and Sarawak. *Figure 3* shows consumer preferences towards different varieties of indigenous fruits. Tarap (27%), kuini (21%) and dabai (18%) were the most purchased fruits relative to the other fruits such as bambangan (14%), engkalak (10%), belimbing hutan (6%) and asam gelugur (4%). The purchase frequency for more than 10 times within a month was 11% and 13% between 3 and 5 times within a month. On average, respondents spent about RM4.84 per month to purchase indigenous

Table 1. Demographic profile of consumer survey in Sabah and Sarawak

Item	Characteristics	% (n = 500)
Age	<20	20
	21 – 35	50
	36 – 50	23
	51 – 65	6
	65 – 80	1
Education	Primary school	10
	Secondary school	52
	Collage/University	37
	Informal education	1
Household income	<RM3,000	77
	RM3,001 – RM5,000	13
	RM5,001 – RM7,000	5
	RM7,001 – RM10,000	3
	>RM10,000	2
Household size	<3	30
	4 – 6	51
	7 – 9	15
	>10	4
Access markets	Morning/night/tamu marmarke Market	33
	Wholesale/wet	21
	Supermarkets	17
	Own plant	14
	Mini markets	9
	Grocery shops	5
Indigenous fruit consumers on regular basis	Yes	87
	No	13
Indigenous fruits are less /inaccessible in common markets	Agreed	49
	Did not agree	51

Source: Consumer survey (2019)

fruits which was much lower compared to RM16.30 per month for premium fruits. The price of indigenous fruits depends on availability in the market. Dabai can hit up to RM50 per kg during off-season while tarap can reach RM30 per piece with a weight of almost 1kg. Most of these indigenous fruits were seasonal fruits and the season was different for each region.

According to a survey reported by the Department of Statistics Malaysia (2019), average household expenditure on food and non-alcoholic beverages was RM725.94 per month. The report indicated that indigenous fruits and premium fruits contributed 0.67% and 2.25% respectively, to total food and non-alcoholic beverages household expenditure per month. Although the

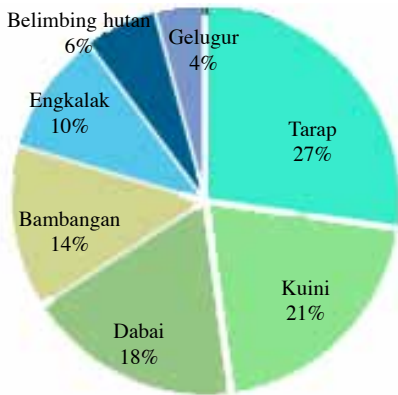


Figure 3. Consumer preferences on indigenous fruits in Sabah and Sarawak
Source: Consumer Survey (2019)

demand was not comparable to premium fruits, indigenous fruits had their own position in fruit markets for both fresh and value-added products. A wide range of value-added products was produced by utilising indigenous fruit species comprising of food ingredients, snacks and juices, hence expanding the value-added products businesses in Sabah and Sarawak.

Logistic regression explained the direction of the relationship between a predictor and the response variable. Table 2 shows the results of logistic regression model of indigenous fruits consumption.

Nagelkerke R^2 was used to explain the variance which indicated that the model explained 44% of the variance in indigenous fruits consumption. Four independent variables were included to explain indigenous fruits consumption. Household income and gender were not significant but should be included in this model to make the value $-2 \log$ likelihood positive and higher (105.088). The results revealed that age was positively related ($B = 0.456$) to indigenous fruits consumption and significant at 0.05 level. The value of an odd ratio for the age variable of more than 1 meant that there was a greater impact for the consumption of the fruits which was 1.6 [Exp (B) 1.578] times greater for the consumption with every one unit increase in age. It implied that

the older respondents were most likely to consume indigenous fruits and the increase in age had given the respondents exposure to the importance and nutritional value of the fruits. It caused a higher consumption among older respondents compared to the younger ones. However, education level was negatively related ($B = -0.380$) to the fruits consumption and significant at 0.1 level and the predictors lowers the consumption at 31.6% [Exp (B) 1 - 0.684]. It indicated that the respondents with lower education consumed more indigenous fruits. They preferred to stay in rural areas where daily expenses was lower than staying in urban areas. In addition, the food supply including indigenous fruits was accessible. It leads to the higher consumption of the fruits among less educated respondents. The values of the standard error (S.E) in Table 2 showed there were no multi-collinearity assisted as it was in the range of ± 2.0 (Chua 2014).

Conclusion and recommendations

The indigenous fruits consumption in Sabah and Sarawak was still relevant despite competition from premium fruits. The market was in fresh and value-added products, particularly for tarap, kuini and dabai. This study indicated that the older and low educational respondents most likely consumed the fruits.

The market and consumption of indigenous fruits were limited and there were species that have still not been explored in terms of benefits and usages. The fruits that had unique texture and taste besides having a short shelf-life has led to the production of value-added products which could be widely marketed commercially. However, limited raw materials have hindered efforts for this commercialisation. The government needs to develop new supportive policies to encourage the cultivation of indigenous fruits among farmers in Malaysia to increase the production of raw materials.

Table 2. Estimated coefficient Logistic Regression model

	B	S.E.	Sig.	Exp (B)	-2 Log likelihood	Nagelkerke R ²
Gender	-0.021	0.277	0.940	0.979	105.088	0.44
Education level	-0.380*	0.212	0.073	0.684		
Household income	0.246	0.206	0.233	1.279		
Age	0.456**	0.184	0.013	1.578		
Constant	1.528	0.627	0.015	4.608		

*Significant at 0.1 level

**Significant at 0.05 level

Source: Consumer Survey (2019)

The value-added products can create new industries which will have an impact on the socio-economic development by creating more Small and Medium Industries (SMEs) entrepreneurs and helping the entrepreneurs and industry generate profits which will further boost the country's income. In addition, a new industry will create job opportunities for local residents besides stimulating socio-economic development in the surrounding areas.

Further R & D is recommended on nutritional values of indigenous fruits to encourage people to consume the fruits for a better and healthy society. Besides eating the fruits fresh, they can also be consumed as processed products. Technology in the diversification of indigenous fruit products should be given more attention to increase the productivity of SMEs. This effort can boost the income of the country as well as assist entrepreneurs especially the Bumiputras in improving their livelihood.

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Abstrak

Malaysia mempunyai kepelbagaian sumber genetik dan sesuai untuk penanaman pelbagai jenis spesies buah. Buah-buahan nadir adalah antara spesies yang kurang dikenali walaupun ia mengelaskan 95% daripada jumlah spesies buah di Malaysia. Pada tahun 2018, jumlah kawasan tanaman buah-buahan nadir di Malaysia adalah 5,900 ha sementara jumlah pengeluaran adalah 41 mt. Sarawak dan Sabah merupakan pengeluar terbesar dan mempunyai keluasan tanaman terbesar yang masing-masing menyumbang 24% dan 54% di Malaysia. Buah-buahan nadir merupakan sumber mineral yang penting selain digunakan sebagai tanaman perubatan yang diamalkan di beberapa kawasan. Namun, perhatian kurang diberikan kepada buah-buahan ini kerana kurangnya kesedaran pengguna mengenai manfaatnya. Objektif utama kajian ini adalah untuk menentukan ciri-ciri pemakan buah-buahan nadir di Sabah dan Sarawak. Data dikumpulkan menggunakan soal selidik melalui survei bersemuka yang melibatkan seramai 500 orang responden. Lokasi kajian adalah di Sabah dan Sarawak, termasuk kawasan bandar (Kuching (n = 125) dan Kota Kinabalu (n = 125) dan luar bandar (Kota Samarahan (n = 125) dan Tawau (n = 125)). Regresi logistik digunakan untuk menentukan faktor-faktor yang menjelaskan pengambilan buah-buahan nadir. Persamaan logistik tidak meramalkan nilai pemboleh ubah bersandar secara langsung, sebaliknya meramalkan kemungkinan berlakunya peristiwa. Empat pemboleh ubah tidak bersandar (jantina, tahap pendidikan, pendapatan dan usia isi rumah) digunakan untuk menjelaskan penggunaan buah-buahan nadir. Model regresi logistik didapati signifikan pada 0.05 ($B = 16.77$) dan menunjukkan data sesuai dengan model berdasarkan ujian Hosmer dan Lemeshow. Tahap dan umur pendidikan masing-masing signifikan pada 0.1 dan 0.05. Umur berkaitan secara positif ($B = 0.456$) dengan penggunaan buah-buahan nadir dan signifikan pada 0.05. Nilai nisbah ganjil lebih dari 1 menunjukkan kesan yang lebih tinggi untuk penggunaan buah-buahan nadir dengan 1.6 [Exp (B) 1.578] kali lebih besar untuk penggunaannya dengan peningkatan setiap satu tahun. Angka itu menjelaskan bahawa mereka yang lebih berusia lebih gemar memakan buah tersebut. Walau bagaimanapun, tahap pendidikan mempunyai kaitan negatif ($B = 0.380$) dan signifikan pada 0.1. Nilai nisbah ganjil untuk tahap pendidikan lebih rendah daripada 1 memberi kesan kecil kepada penggunaan buah-buahan nadir dan menunjukkan faktor tersebut menurunkan penggunaan buah-buahan pada kadar 31.6% [Exp (B) 1 - 0.684]. Data menunjukkan responden yang berpendidikan rendah lebih banyak mengambil buah-buahan nadir. R&D lebih lanjut disarankan mengenai kesedaran pemakanan buah-buahan nadir bagi menggalakkan pengguna mengambil buah-buahan ini seterusnya menyumbang kepada masyarakat yang sihat. Perhatian harus diberikan dalam pemprosesan yang minimum kerana perubahan gaya hidup dan saiz keluarga kecil dan ia telah digunakan untuk buah-buahan premium. Teknologi dalam mempelbagaikan produk buah-buahan nadir harus ditingkatkan dalam meningkatkan produktiviti Industri Kecil dan Sederhana (IKS) di samping untuk meningkatkan pendapatan pengusaha dan memberi peluang pekerjaan kepada penduduk setempat.

Appendix 1. Hectarage and production of indigenous fruits in Malaysia (2016 – 2018)

State	2016			2017			2018		
	Area (ha)	Production ('000 mt)	Area (ha)	Production ('000 mt)	Area (ha)	Production ('000 mt)	Area (ha)	Production ('000 mt)	
Johor	562.34	7.79	903.79	11.62	665.86	7.19			
Kedah	127.82	0.878	132.65	1.17	168.02	1.80			
Kelantan	383.74	5.90	363.40	5.99	369.37	6.69			
Melaka	364.89	2.89	328.44	2.74	223.31	1.73			
Negeri Sembilan	139.56	2.50	161.31	2.57	372.61	7.84			
Pahang	507.35	3.71	462.05	3.52	641.44	3.23			
Perak	117.43	1.19	100.75	1.14	108.90	1.04			
Perlis	7.53	0.01	17.00	0.06	-	-			
Pulau Pinang	7.50	0.03	5.65	0.01	-	-			
Selangor	141.76	1.82	96.77	1.51	103.02	1.55			
Terengganu	371.67	6.13	93.78	0.60	70.68	0.49			
Semenanjung Malaysia	2,731.59	32.84	2,665.59	30.93	2,723.21	31.54			
Sabah	719.40	3.75	722.30	1.58	735.00	1.91			
Sarawak	2,181.10	6.38	2,111.50	6.41	2,537.70	7.76			
Wp. Labuan	2.30	0.01	2.10	0.01	1.85	0.01			
Malaysia	5,634.39	42.98	5,501.49	38.93	5,997.76	41.21			

Source: DOA (2018)