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Nutritional status and complementary feeding among Penan infants and young children in rural Sarawak, Malaysia

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ABSTRACT

Introduction: The Penan people are largely settled in rural and remote areas of Sarawak with high rates of undernutrition among the children. The study aimed to determine the nutritional status and infant and young child feeding (IYCF) practices of Penan children. **Methods**: Subjects consisted of 121 children, aged between 0-23 months, from 15 Penan longhouses in Belaga district. Malnutrition was assessed using anthropometric measurements of children and categorised according to the World Health Organization (WHO) Growth Standards (2006). Feeding practices were assessed using questionnaires based on WHO IYCF Indicators (2008). **Results**: The prevalence of underweight was 29.8%; stunting 43.0% and wasting 5.8%. Prevalence of exclusive breastfeeding under 6 months was 44.4%. About 86% of infants aged 6-8 months were already given solid, semi-solid and soft foods. The proportion of children aged 6-23 months achieving minimum dietary diversity (MDD) was 76.6%, while minimum meal frequency (MMF) was 83.0% (breastfed and non-breastfed). Among the children who achieved MDD, 64.9% of their meals were derived from 4-5 food groups. More than half (55.3%) of all subjects (breastfed and non-breastfed) received minimum acceptable diet (MAD). Achievement of iron-rich foods (IRF) indicator was 77.7%. There was no significant association between the IYCF indicators of MDD, MMF and MAD and underweight, stunting and wasting. **Conclusion**: A high prevalence of poor nutritional status was recorded among the Penan children. While the IYCF indicators apparently showed satisfactory complementary feeding practices, future studies should assess quantitatively the intake of complementary food among Penan infants and young children.

Keywords: Infant and young child feeding, nutritional status, Penan, Sarawak

INTRODUCTION

Global estimates show underweight (6.0%), stunting (22.9%) and wasting (7.7%) among children below 5 years old (UNICEF, WHO & World Bank Group, 2017). Undernutrition (underweight, stunting, wasting) is linked with increased morbidity and mortality (Black *et al.*, 2013); as well as non-communicable disease and productive capacity in adulthood (Stewart *et al.*, 2013).

Recent reports revealed that while global prevalence of stunting in children below 5 years has reduced from 37.2%

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in 2000 to 22.9% in 2016, nevertheless a total of 154.8 million stunted children were reported in 2016, and disparities still exist between different regions of the world (UNICEF/WHO/World Bank Group, 2017). A systematic review addressing child health inequities revealed that income and economic status were the structural determinants of child health inequities. The reported child health determinants include shortcomings within the rural health care system and repercussions of food poverty with low health literacy among parents (Schröders *et al.*, 2015).

The national prevalence of stunting among children below 5 years in Malaysia was 20.7% in 2016, with Sarawak having a high rate at 23.1% compared to the other states. Overall, the prevalence of stunting was higher in rural localities (23.3%) than urban areas (19.2%). In terms of ethnicity, "Other Bumiputera"[1] recorded the highest prevalence of stunting at 24.5% (IPH, 2016).

A cross-sectional study in Serian District, Sarawak reported 20.9% underweight, 10.2% wasting and 11.9% stunting among children below 5 years (Eunice, Cheah & Lee, 2014). The study also revealed only 64.4% of subjects had been given complementary foods starting from the age of 6 months and above. In order to reduce child undernutrition and stunting, effective nutrition-specific interventions such as breastfeeding and appropriate complementary feeding of children need to be scaled up, especially in children below 2 years. It has been estimated that nutrition-specific interventions such as infant and young child feeding packages could save 221,000 lives when implemented together with other nutrition interventions at 90% coverage (Bhutta *et al.*, 2013).

The National Health and Morbidity Survey (NHMS) (2016) reported the prevalence of exclusive breastfeeding amongst infants below 6 months in Malaysia at 47.1% (IPH, 2016). This is a substantial increase compared to the prevalence of 14.5% in 2006 (IPH, 2008). Meanwhile the national prevalence of timely complementary feeding among children aged 6-10 months in 2006 was 41.5% (Khor *et al.*, 2009).

A study conducted in Klang District, Malaysia reported 43.1% prevalence of exclusive breastfeeding among infants aged 1-6 months (Tan, 2011). A study conducted among 173 "Orang Asli"[2] children (*Temuan and Mah Meri*) in Sepang district and Carey Island, Selangor reported that 33% of the mothers stopped breastfeeding before their infants were 6 months old, while 31% breastfed their children for more than one year (Wan Norlida *et al.*, 2007). The authors also found insufficient mean number of servings for all food groups and high under-nutrition rates among these Orang Asli children aged 1-3 years.

The Penan community is part of the Dayak group in Sarawak, Brunei and Kalimantan (Sercombe, 2008). Sarawak is home to an estimated 16,000 tribal Penans, living in remote areas of Baram and Belaga districts, with 77% living in permanent settlements, 20% leading a semi-nomadic lifestyle, while another 3% live as nomads. Almost two thirds of the Penan population live in Baram, Tutoh and Limbang areas and have been referred to as Eastern Penans. Meanwhile, Western Penans live mostly in the vicinity of Bintulu, and Belaga district (Lyndon *et al.*, 2013).

Primary health care is delivered to the rural community through various modes, such as static health clinics, mobile health teams and flying doctor service. Furthermore, to address malnutrition among Penan children aged below 6 years, two community feeding programmes were implemented in Sarawak from 2013 (Ministry of Health Malaysia, 2014). The community feeding programmes comprise supplementary feeding, provision of complementary foods, nutrition education and efforts

[1] "Other Bumiputera" meaning native tribes of Sarawak and Sabah, including Dayak
[2] "Orang Asli" meaning aboriginal tribes of Peninsular Malaysia.

to improve personal hygiene and environmental sanitation.

The Third National Plan of Action for Nutrition Malaysia has identified specified targets to improve infant and young child feeding practices and nutritional status of children (NCCFN, 2016). There is a lack of data on the quality of complementary feeding in Malaysia (NCCFN, 2011).

Despite high undernutrition rates, studies on infant and young child feeding practices amongst Penan children, especially complementary feeding practices, have not been extensively carried out. Two previous studies that included assessment of nutritional status amongst children were undertaken in the 1970-1980s (Anderson, 2015; Chen, 1984).

This study focused on complementary feeding in children aged below 24 months, based on the World Health Organization (WHO) infant and young child feeding (IYCF) indicators of minimum dietary diversity (MDD), minimum meal frequency (MMF) and minimum adequate diet (MAD). The objective of this study was to determine the nutritional status and infant and young child feeding practices in a sample of Penan children in Belaga district, Sarawak.

MATERIALS AND METHODS

Study design

This is a cross-sectional study which was carried out in Belaga district, Sarawak. Period of data collection was between August-December 2016.

Participants

Written permission was obtained from the Belaga District Office in May 2016 before carrying out the study. Following that, verbal permission was also obtained from each Penan community leader or *Tuai Rumah* before the study was carried out in each locality.

A total of 121 Penan infants (n=52) and young children aged 12.0-23.9 months (n=69) were recruited based on the following inclusion criteria: i) Penan; ii) aged below 24 months; iii) free of physical disability and known diseases. Written consent was obtained from mothers and caregivers of the Penan children who participated in the study.

Data collection

Anthropometric measurements including weight and length measurements of the children were taken. Recumbent length measurements of children were performed using SECA 210 measuring mat and recorded to the nearest 0.1 cm. Children's weight measurements were carried out using SECA 803 weighing scale. Weight measurement was recorded to the nearest 0.01 kg. Infants were weighed together with their mothers, and after that, their mothers were weighed, with the difference being recorded as the child's weight. Body length and weight measurements consisted of two readings for each child, and the average value was then recorded.

Nutritional status of children was categorised according to the WHO Child Growth Standards (WHO, 2006), based on three indicators namely, weight-for age z-scores (WAZ), length/height-for-age z-scores (HAZ) and weight-for-height z-scores (WHZ), which were calculated using WHO *Anthro* software (version 3.2.2). For WAZ, HAZ and WHZ, a cut-off value of below 2 standard deviations (SD) from the median value for the reference population was used to classify underweight, stunting and wasting, respectively.

The Penan mothers or caregivers were interviewed using a pre-tested questionnaire based on the WHO IYCF Indicators (WHO, 2008). The questionnaire consisted of two sections, i) socio-demography and health information of the children, and ii) IYCF practices. Data on the following core IYCF indicators was collected: exclusive breastfeeding under 6 months, continued breastfeeding at 1 year of

age, timely complementary feeding at 6 months, MDD, MMF, MAD and consumption of iron-rich or iron-fortified foods (IRF). MDD was calculated using the food group score (based on seven food groups) for both breastfed and non-breastfed children, and this indicator is considered as achieved if the child had been given foods from at least four food groups the previous day. MMF refers to the minimum number of times the child was given solid, semi-solid or soft foods the previous day, specific for their age range. MMF was calculated for breastfed and non-breastfed children. MAD indicator achievement was calculated based upon the child achieving both the MDD and MMF indicators during the previous day. MAD was calculated for breastfed and non-breastfed subjects. Optional indicators for infant and young child feeding practices were also collected: continued breastfeeding at 2 years and bottle-feeding practices.

Data analysis

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) software version 20. Descriptive statistics including mean and standard deviation was used. Independent Chi-square test and logistic regression analysis were used to determine association between factors contributing to malnutrition and nutritional status of children aged below 2 years.

Ethics approval

This study was approved by the Medical Research and Ethical Committee of Universiti Kebangsaan Malaysia (UKM/PPI/111/8/JEP-2016-381).

RESULTS

A total of 121 Penan infants and children participated in this study (Table 1). There were 22.3% aged below 5.9 months, 20.7% aged 6.0-11.9 months and 57.0% aged 12.0-23.9 months. Available birth records obtained from home-based child health cards showed 14.9% low birth weight (<2500g) among the study subjects. Their mean birth weight was 2.78±0.40 kg, ranging from 1.30-4.00 kg.

The mean age of their mothers was 24.6±7.0 years. With regards to mother's education status, 54.5% were without any formal schooling, while 34.7% and 10.7% had attended primary and secondary school respectively.

The mean household size was 7.3±3.9, ranging from 3-25. A total of 52.1% reported household size of ≥ 7. Almost all (96.5%) the mothers reported having household income level below the poverty line income (EPU, 2014).

Table 2 shows the nutritional indices of the children by age group and sex. There was no significant difference between the mean weight of boys and girls for each age group. For all age groups (0.0-5.9 months; 6.0-11.9 months; 12.0-23.9 months), there was no significant difference in mean length-for-age z-scores (LAZ) between boys and girls.

In terms of weight-for-age z-scores (WAZ), 70.2% of subjects had normal WAZ, while 29.8% were underweight (WAZ < -2SD). Among underweight children, 3.3% of children were severely underweight (WAZ < -3SD).

Stunting prevalence (LAZ < -2SD) among the children was 43.0%, while the rest achieved normal length-for-age status (57.0%).

A total of 94.2% of children had normal weight-for-height status, while wasting prevalence was 5.8% (WLZ < -2SD). Among subjects categorised as wasting, 0.8% suffered from severe wasting (WLZ < -3SD).

Overall, there was no statistically significant association between sex and all three nutritional status indicators of underweight, stunting and wasting (p>0.05). Also, there was no significant association between child age group and underweight, stunting and wasting (p>0.05).

Table 1. Socio-demographic characteristics of study sample (*n*=121)

Characteristics	*n*	*Percentage (%)*
Sex of child		
Male	64	52.9
Female	57	47.1
Age of child		
0.0-5.9 months	27	22.3
6.0-11.9 months	25	20.7
12.0- 23.9 months	69	57.0
Birth weight		
< 2500 g	18	14.9
≥ 2500 g	103	85.1
Number of children in the household		
< 3	72	59.5
≥ 3	49	40.5
Age of mother		
< 25 years	70	57.9
25-34 years	35	28.9
35-44 years	15	12.4
≥ 45 years	1	0.8
Mother's education		
No schooling	66	54.5
Primary school	42	34.7
Secondary school	13	10.7
Household size		
< 7	58	47.9
≥ 7	63	52.1
Household income[†]		
Household income ≤ RM 610 (extremely poor)	105	93.8
RM610 < Household income ≤ RM 920 (poor)	3	2.7
RM 920 < Household income < RM 2000 (medium)	4	3.6

[†]*n*=112, 9 respondents did not report household income; the poverty line income classification used was based upon recent guidelines (Economic Planning Unit Prime Minister's Department, 2014).

Table 3 shows the IYCF practices among the Penans. A total of 65.3% were breastfed (had been given breast milk the previous day). Out of 27 infants aged < 6 months, exclusive breastfeeding prevalence was 44.4%. Prevalence of continued breastfeeding at age of one year was 66.7% while 38.2% continued breastfeeding up to two years. The prevalence of bottle feeding was 46.3% among children aged 0.0-23.9 months. Milk feeds given included formula milk and sweetened condensed milk.

In terms of timing of introduction of complementary feeding, 85.7% infants aged 6.0-8.9 months had been given complementary foods (Table 3). Common staple foods fed as complementary foods included rice porridge, rice and sago (soft paste made up of sago flour and water).

The proportion of children (6.0-23.9 months) achieving MDD was 76.6%. The study shows that 41.5% were fed at least four food groups, while another 23.4% consumed five food groups. Nonetheless,

Table 2. Mean weight (kg), mean length (cm) and nutritional status by age group and sex (n=121)

Variable	*Age group (months)*	n (%)	*Boys (n=64)*			*Girls (n=57)*			*p-value between sexes*†
			n	*Mean±SD*	*(95% CI)*	*n*	*Mean±SD*	*(95% CI)*	
Weight (kg)	0.0 – 5.9		14	5.71 ± 0.84	(5.23 – 6.20)	13	4.92 ± 1.37	(4.10 – 5.75)	0.080
	6.0 – 11.9		14	7.49 ± 0.91	(6.97 – 8.02)	11	7.07 ± 0.94	(6.44 – 7.70)	0.270
	12.0 – 23.9		36	9.46 ± 1.15	(9.07 – 9.85)	33	8.89 ± 1.43	(8.38 – 9.40)	0.165‡
	0.0 – 23.9		64	8.21 ± 1.85	(7.70 – 8.70)	57	7.64 ± 2.10	(7.10 – 8.20)	
Length (cm)	0.0 – 5.9		14	58.9 ± 3.6	(56.8 – 60.9)	13	56.6 ± 4.9	(53.7– 59.6)	0.325‡
	6.0 – 11.9		14	67.4 ± 4.1	(65.1 – 69.8)	11	66.8 ± 2.8	(64.9 – 68.7)	0.691
	12.0 – 23.9		36	77.9 ± 4.8	(76.3 – 79.6)	33	75.9 ± 5.5	(73.9 – 77.9)	0.108
	0.0 – 23.9		64	71.5 ± 9.0	(69.2 – 73.7)	57	69.8 ± 9.4	(67.3 – 72.2)	
WAZ	0.0 – 5.9		14	-1.26 ± 1.00	(-1.84 – -0.68)	13	-1.11 ± 0.85	(-1.63 – -0.60)	0.688
	6.0 – 11.9		14	-1.34 ± 0.94	(-1.89 – -0.80)	11	-1.48 ± 0.99	(-2.14 – -0.81)	0.727
	12.0 – 23.9		36	-1.57 ± 0.91	(-1.88 – -1.26)	33	-1.37 ± 1.00	(-1.72 – -1.02)	0.383
Underweight (WAZ < -2SD)		36 (29.8)							
LAZ	0.0 – 5.9		14	-1.72 ± 1.16	(-2.39 – -1.05)	13	-1.19 ± 1.18	(-1.90 – -0.48)	0.254
	6.0 – 11.9		14	-1.53 ± 1.24	(-2.25 – -0.82)	11	-1.74 ± 0.83	(-2.30 – -1.18)	0.572‡
	12.0 – 23.9		36	-2.03 ± 1.18	(-2.43 – -1.63)	33	-1.83 ± 1.23	(-2.27 – -1.39)	0.500
Stunting (LAZ < -2SD)		52 (43.0)							
WLZ	0.0 – 5.9		14	0.17 ± 0.80	(-0.29 – 0.64)	13	-0.38 ± 1.17	(-1.09 – 0.32)	0.158
	6.0 – 11.9		14	-0.53 ± 1.20	(-1.21 – -0.17)	11	-0.69 ± 1.07	(-1.40 – 0.03)	0.729
	12.0 – 23.9		36	-0.80 ± 0.96	(-1.12 – -0.47)	33	-0.61 ± 0.98	(-0.95 – -0.26)	0.244‡
Wasting (WLZ < -2SD)		7 (5.8)							

†independent t–test
‡independent Mann-Whitney U test

Table 3. Infant and young child feeding practices

Achievement of IYCF indicators	*n*	*Percentage (%)*	*Criteria for IYCF indicator*
Breastfeeding	79	65.3	Proportion of children 0-23 months of age breastfed
Exclusive breastfeeding under 6 months	12	44.4	Proportion of infants 0-5 months of age fed exclusively with breast milk
Continued breastfeeding at 1 year	12	66.7	Proportion of children 12-15 months of age who are fed breast milk
Continued breastfeeding at 2 years	13	38.2	Proportion of children 20-23 months of age who are fed breast milk
Introduction of solid, semi-solid and soft foods	12	85.7	Proportion of infants 6-8 months of age who receive solid, semi-solid or soft foods
Minimum dietary diversity (MDD)	72	76.6	Proportion of children 6-23 months of age who receive foods from 4 or more food groups
Minimum meal frequency (MMF)	78	83.0	Proportion of breastfed and non-breastfed children 6-23 months of age who receive solid, semi-solid or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more
Minimum acceptable diet (MAD)	52	55.3	Proportion of breastfed and non-breastfed children 6-23 months of age who receive a MAD
Iron-rich or iron-fortified foods (IRF)	73	77.7	Proportion of children 6-23 months of age who receive an IRF
Number of food groups given			
0	2	2.1	
1	2	2.1	
2	9	9.6	
3	9	9.6	
4	39	41.5	
5	22	23.4	
6	9	9.6	
7	2	2.1	
Food groups given			
Grains, roots and tubers	91	96.8	
Legumes and nuts	5	5.3	
Dairy products	45	47.9	
Flesh foods	73	77.7	
Eggs	52	55.3	
Vitamin-A rich fruits and vegetables	80	85.1	
Other fruits and vegetables	35	37.2	
Children who received iron-rich foods (IRF)			
6.0-11.9 months (n=25)	16	64.0	
12.0-23.9 months (n=69)	57	82.6	
Total	73	77.7	

Table 4. Infant and young child feeding indicators by nutritional status

Indicator	*Weight-for-age (WAZ)*					*Length-for-age (LAZ)*					*Weight-for-length (WLZ)*				
	Under-weight (n=32)		*Not under-weight (n=62)*		x^2 *(p-value)*[†]	*Stunting (n=43)*		*Not stunting (n=51)*		x^2 *(p-value)*[†]	*Wasting (n=7)*		*Not wasting (n=87)*		x^2 *(p-value)*[‡]
	n	*%*	*n*	*%*		*n*	*%*	*n*	*%*		*n*	*%*	*n*	*%*	
MDD															
Yes	25	34.7	47	65.3	0.063	33	45.8	39	54.2	0.001	4	5.6	68	94.4	
No	7	31.8	15	68.2	(0.801)	10	45.5	12	54.5	(0.975)	3	13.6	19	86.4	(0.348)[‡]
MMF															
Yes	28	35.9	50	64.1	0.702	39	50.0	39	50.0	3.343	6	7.7	72	92.3	
No	4	25.0	12	75.0	(0.402)	4	25.0	12	75.0	(0.067)	1	6.2	15	93.8	(1.000)[‡]
MAD															
Yes	21	40.4	31	59.6	2.085	26	50.0	26	50.0	0.849	2	3.8	50	96.2	
No	11	26.2	31	73.8	(0.149)	17	40.5	25	59.5	(0.357)	5	11.9	37	88.1	(0.236)[‡]

[†]Independent chi-square test
[‡]Fisher's exact test
Abbreviation: MDD, minimum dietary diversity; MMF, minimum meal frequency; MAD, minimum acceptable diet

23.4% were given less than four food groups. For the type of complementary foods given, almost all (96.8%) had been given grains, roots and tubers. While 77.7% were given animal foods (meat, fish, poultry, liver or organ meats), 85.1% children received vitamin-A rich foods and vegetables. Almost half (47.9%) had been given dairy products and 55.3% had consumed eggs. However, the proportion of children fed fruits and vegetables was low (37.2%). Consumption of legumes and nuts was also low at 5.3%.

Achievement of MMF was high at 83.0% (overall for both breastfed and non-breastfed children). The study also revealed that 55.3% had achieved MAD indicator (overall for both breastfed and non-breastfed children). Consumption of IRF was high at 77.7%.

None of the indicators, MDD, MMF and MAD were significantly associated with underweight, stunting and wasting. Children who had achieved MDD showed wasting prevalence of 5.6%, compared with those who did not achieve MDD (13.6%) (Table 4). Children who did not achieve MAD had 11.9% prevalence of wasting compared to 3.8% for those who achieved MAD.

DISCUSSION

Achieving optimal nutritional status of children is important for healthy growth, development and has long term consequences on adult health. Effort to improve nutritional status of children is of global importance, as reflected in global targets, which include 40% stunting reduction in children below five, 30% reduction in low birth weight, reduction of childhood wasting to 5% and also 50% increase in breastfeeding. Targets to increase breastfeeding rates and reduce stunting and wasting prevalence in children below five are also found in the Sustainable Development Goals (GBD 2015 SDG Collaborators, 2016).

Global low birth weight prevalence has been reported at 15% in 2013 (UNICEF, 2013). A previous study reporting that small-for-gestational-age (SGA) and pre-term babies was associated with 4.5 times higher risk of stunting, points to the need for early intervention in order to address foetal growth restriction (FGR) and reduce childhood stunting (Christian *et al.*, 2013). Another study identified FGR (defined as being term and SGA) as the leading individual risk factor contributing to stunting in developing countries (Danaei *et al.*, 2016).

This study showed the Penan community having a high prevalence of low birth weight of 14.9%. Higher low birth weight rates of 18.1% and 16.2% was reported by Eunice *et al.* (2014) in Serian District, Sarawak, and Sarawak state, respectively.

The prevalence of stunting reported in this study was 43.0%, out of which 14.0% were severely stunted (HAZ < -3SD). Higher stunting rates were seen in older children, 46.3% amongst ages 12.0-23.9 months compared to 33.3% in ages 0.0-5.9 months. Prevalence of stunting among the Penans is double the stunting prevalence for children under 5 years in Malaysia (20.7%), and that reported in NHMS 2016 for Sarawak state (IPH, 2016). This study also found 5.8% wasting which is lower than that for Malaysia in general (11.5%) and Sarawak state (12.0%) (IPH, 2016). Underweight prevalence in this study was 29.8%, which is higher compared to Malaysian children below 5 years (13.7%) (IPH, 2016). Higher underweight and stunting prevalence in young Penan children may be attributed to high poverty and food insecurity in the Penans community.

Exclusive breastfeeding prevalence under 6 months in this study (44.4%) is slightly lower than the national prevalence of 47.1% (IPH, 2016). Generally higher exclusive breastfeeding rates were reported in South East Asia region, as 11.0% in Myanmar, 38.9% in

Indonesia, 33.7% in Vietnam and 60.0% in Cambodia (Dibley, Senarath & Agho, 2010). Continued breastfeeding among the Penans decreased from 66.7% at 1 year of age to 38.2% at 2 years old. This finding is in agreement with the global breastfeeding prevalence, which also showed a similar downward trend from 74% at 1 year of age to 46.3% at 2 years old (White *et al.*, 2017).

Recent reports on global estimates for complementary feeding practices indicated a third of infants 4-5 months old were already fed solid foods; whereas 20% of 10-11 months old had not started solid foods (White *et al.*, 2017). This report noted that achievement of MDD was low (28.2%) and suggested that continuous effort is needed to ensure more children benefit from optimal complementary feeding.

Achievement of introduction to solid, semi-solid and soft foods and minimum meal frequency indicators among the study subjects was high at 85.7% and 83.0% respectively. Previous studies conducted in Kuala Lumpur and Putrajaya also reported that 97.9% of infants were given timely introduction to solid food and 95.2% achieved MMF (Khor *et al.*, 2016). Minimum dietary diversity achievement for the Penan children was satisfactory at 76.6%, similar to that for Sarawak state (76.4%) as reported in NHMS 2016, whilst the national prevalence of MDD was 66.4% (IPH, 2016). Achievement of MAD was lower at 55.3% and slightly higher compared with MAD achievement for Malaysia which is 53.1% (IPH, 2016). Consumption of IRF among the Penans children was satisfactory at 77.7%. Overall, the qualitative aspects of complementary feeding of young Penan children appear satisfactory based on the use of the WHO (2008) indicators.

This study did not find significant associations between the IYCF indicators and nutritional status. Besides IYCF practices, several other factors may cause undernutrition in children (Jones *et al.*, 2014). Furthermore, use of the IYCF indicators might not reflect usual intake (Saaka *et al.*, 2015) and does not capture portion sizes or amounts of food given or fat intake of children. Furthermore, poor physical and environmental sanitation are contributing factors to malnutrition in children (Schmidt, 2014; Bentley *et al.*, 2015).

Nutrition education is one of the components of the community feeding programme for Penan children. In light of current findings, namely higher prevalence of malnutrition among infants and young children, nutrition education should be strengthened. Nutrition education of the Penans needs to be context-specific, taking into consideration the current IYCF practices and availability of local complementary foods. Further studies on environmental factors and household food insecurity of the Penan community are needed to identify factors associated with malnutrition among the young children.

Limitations of study

A major limitation encountered in this study is the language barrier, as interviews with the Penan mothers had to be conducted in the Malay language. However, whenever necessary, Kayan language was used if the mothers had difficulty in understanding Malay. Translation in the process may have altered the meaning of some local words or terms. The indicators used depended on the mother's ability to recall and this posed challenges in some instances.

CONCLUSION

A high prevalence of poor nutritional status was recorded among the Penan children. While the IYCF indicators apparently showed satisfactory complementary feeding practices, future studies should assess quantitatively the intake of complementary food among Penan infants and young children. In light of the high rate of low birth weight in

the Penan community (14.9%), nutrition education is needed for pregnant women to ensure healthy weight gain of both mother and child. Further studies to be conducted among Penan children should include assessment of household food insecurity and evaluation of environmental factors which may contribute to child malnutrition.

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Author's contributions

BMW, conceptualised and designed the study, conducted the study, conducted data collection, data analysis and interpretation, prepared the draft of the manuscript and reviewed the manuscript; NAK, conceptualised and designed the study, conducted the study, conducted data analysis and interpretation, prepared the draft of the manuscript and reviewed the manuscript; IMN, conceptualised and designed the study, conducted the study, conducted data analysis and interpretation, prepared the draft of the manuscript and reviewed the manuscript.

Conflict of Interest

The authors declare no conflict of interest in undertaking this study.

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