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Factors Influencing Malnutrition among Young Children in a Rural Community of Sarawak

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ABSTRACT

Introduction: This study aimed to determine the prevalence of malnutrition and factors influencing malnutrition among children aged five years and below in Serian District of Sarawak, a district where the majority of people are indigenous. **Methods**: Using a cross-sectional method, a total of 177 children were randomly selected and assessed, and their mothers or caregivers were interviewed. Data were collected using a pretested questionnaire; anthropometric measurements were also taken. Data were analysed using SPSS version 17.0. **Results**: The prevalence of underweight, stunting and wasting in children aged five years and below was 20.9%, 11.9% and 10.2% respectively. The results suggest that the significant factors contributing to underweight are birth weight, frequency of child visit to the clinic, and individual insecurity. Only age, when complementary diet was introduced, was found to be significantly associated with stunting. For wasting, individual insecurity, duration of family planning and met recommended protein intake per day were found to be significant factors. **Conclusion**: The prevalence of malnutrition in children 5 years and below in Serian District of Sarawak is high compared to state figures. The major contributing factors were found to be manifested at the individual and family level. There is a need for appropriate public health promotion and socio-economic improvement interventions towards improving the nutritional status and health of children in Serian District.

Key words : Causes, children, malnutrition in children, undernutrition, underweight

INTRODUCTION

Malnutrition is associated with about half of all child deaths worldwide. Children who are malnourished usually have lowered resistance to infection. They are more likely to die from common childhood ailments like diarrhoeal diseases and respiratory infections. For those who survive, frequent illness saps their nutritional status, locking them into a vicious cycle of recurring sickness, faltering growth and diminished learning ability (Ergin *et al.*, 2007).

In developing countries, malnutrition is still a major health problem (Muller & Krawinkel, 2005). Like many other developing countries, Malaysia had a history of malnutrition prevalence (Khor, 2003) but since independence in 1957, progress in both

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socio-economic and health care has greatly improved the nutritional status of children. Various studies have been conducted extensively on the nutritional status of children in Malaysia. There has been a dramatic decline in infant mortality and toddler mortality rates (Tee, 1999). Infant mortality rates had declined from 73 per 1,000 live births in 1960 to 7 per 1,000 live births in 2003, while the toddlers mortality rates had declined from 10.5 per 1,000 live births in 1960 to 7 per 1,000 live births in 2003 (UNICEF, 2005). According to the MOH/UNICEF Survey undertaken nationwide in 1998–2000 among children less than 6 years, 19.2% were underweight (<-2SD weight for age) and 16.7% were stunted (<-2SD height for age) (MOH, 2005). Based on surveillance data of the Ministry of Health (MOH), Malaysia, the overall prevalence of underweight among children below 5 years was 17.3% in 2004 compared to 25% in 1990. However, studies often report prevalence of underweight and stunting in children of similar ages from poor households, particularly in the rural communities, exceeding 25% and 30% respectively (MOH, 2005). Hence, despite great achievements in Malaysian health data, nutrition problems, especially underweight and stunting, are still a major health problem especially in rural communities. The latest National Health and Morbidity survey of 21,000 children in 2006, found 12.9% of the children to be malnourished with 17.2% being stunted (MOH, 2008). The survey highlighted the same issues of growth faltering after 6 months of age (reflecting improper complementary feeding) and severe malnutrition among infants in rural areas where health services were limited. Chronic malnutrition manifested by stunting has virtually unchanged over the preceding decade (Khor *et al.*, 2009).

Studies all over the world have shown that nutritional problems share many similar factors in their aetiology (Griffiths *et al.*, 2004). Past studies in Malaysia also report a similar pattern of relationship between socio-demographic factors and nutritional status of children from rural communities (Chee *et al.*, 2002). Most of the factors are interrelated including biological, social, cultural and economic aspects. The influences of these factors can originate and manifest at different levels of the child's environment, for example, in the family, household, community and national level (Griffiths *et al.*, 2004). To plan and deliver an effective intervention programme for children, determination of contributing factors to malnutrition is vital, particularly if the resources are limited. Furthermore, each geographical area has its own uniqueness in term of cultural difference that can affect the lifestyle and behaviour. Sarawak has been ranked among the states with the highest under-nutrition cases (MOH, 2004). The Annual Report (2011) (MOH, 2011) of the Sarawak Health Department showed that the percentage of children with moderate to severe malnutrition in 2010 was 10.7%. It was reported that the prevalence of malnutrition in Serian District was 12.4%, which is higher than the state's average (MOH, 2011). Thus, the aim of this study was to determine factors influencing malnutrition in children aged five years and below in Serian District, one of the rural communities that has the highest prevalence of child malnutrition in Sarawak (MOH, 2011).

METHODS

The study was conducted in Serian District, a rural district with an area of 2,039.9 square kilometers in Samarahan Division, Sarawak, East Malaysia. This district is located about 65km from Kuching, the state capital of Sarawak with a total population of about 100,000 people. About 65% of the population are Bidayuhs, the biggest indigenous community while the rest are Ibans, Chinese and Malays (Department of Statistics Malaysia, 2011). This population is served by ten health clinics. The data for this study

were collected from all the 10 clinics in all the districts in Serian.

The respondents for this study were children in Serian District in Samarahan Division Sarawak aged five years and below. These children regularly visit the government health clinics in Serian District for their immunisation, medical assessment and treatment.

It was a cross-sectional study conducted from July 2011 to February 2012. Using Open Epi software, based on the total population of 7,984 at a prevalence of 12.4% (Ministry of Health, 2011), the minimum sample size needed was 164. An estimated 17 to 18 children were recruited from each of the ten clinics in the district. The inclusion criteria for children were: (i) aged 60 months and below; (ii) having parents or caregivers residing in the area for more than 6 months; and (iii) without any reported mental retardation, physical disability or chronic illness. List of patients' names were obtained from all the selected clinics as the sampling frame. Systematic sampling was carried out based on an interval of 3. On identifying the child, the mother or caregiver will be interviewed. Written consent to participate in the study was obtained from the child's mother or caregiver.

Anthropometric measurements of height and weight were taken based on the protocol by World Health Organisation (WHO, 1995). For children who could stand, height was measured using a SECA body-meter to the nearest 0.1 cm. For infants, length was measured using the SECA washable measuring mat with the help of a nurse at the clinic. The child was laid down on the mat in supine position with one person holding the child's head against the backboard and with the crown perpendicular to the backboard. The long axis of the child's body was kept aligned with the centre of the backboard with the child's shoulders and buttocks touching the backboard, and the shoulders and hip at right angles to the long axis of the body. With child's leg kept straight and against the backboard, the footboard was slided against the bottom of the feet (without socks or shoes) with the toes pointing upward and the measurement was read to the nearest 0.1cm. For weight measurement, SECA weighing scale (electronic scale) was used. Children who could stand without assistance were weighed on a platform electronic scale. The subjects, barefoot and with minimal clothing, were made to stand still in the middle of the scale's platform without touching anything. Infants weighed on the platform scale were held by the mother. The mother's weight was subtracted from the reading (mother and child) to get the infant weight. The measurement taken was read to the nearest 0.1cm. The classification of malnutrition was based on WHO Child Growth Standards 2006 (WHO Multicentre Growth Reference Study Group, 2006).

The mother or caregiver of the child was interviewed using a pretested questionnaire that consisted of three main sections. Section one consisted of background information of respondent, factors that contribute to malnutrition from the perspective of the individual (child), family and community. These questions were adapted from Cheah *et al*. (2009). The second part of the questionnaire was from Radimer/Cornell Hunger and Food Insecurity instrument (Radimer *et al.,* 1992), validated in Malay language (Aflah, 2006). Using responses of "not true" (1) to "often true" (3), the scores were further classified to four levels of food insecurity – food secure, household food insecure, individual or adult food insecure and child hunger. Based on Radimer/Cornell Hunger Instrument, the definition of food security includes two important criteria which are (i) ready availability of nutritionally adequate and safe food; and (ii) the assured ability to acquire acceptable food in socially acceptable ways. Individual insecurity simply means one's inability to get access to sufficient food. Child hunger occurs only after the adults in the households

and the children's diet quality have been affected by household food shortages. Part three of the questionnaire was on 24-hour diet recall.

The data were analysed using Statistical Package for the Social Sciences (SPSS) version 17.0. The *z*-score from each anthropometric measurement was generated by using WHO Anthroplus Programme Version 3.2.2 (WHO, 2009). Multiple Logistics Regression was used to determine the factors contributing to malnutrition among children aged five years and below in Serian District. This study was approved by the Medical Research and Ethical Committee of UNIMAS and the Clinical Research Centre, Ministry of Health Malaysia (NMRR-11-895-10232).

RESULTS

A total of 177 children and their mothers or caregivers from 10 clinics participated in this study. Almost half of the respondents were female (46.3%). About 40% of the children were in the age group >2 years. The Bidayuh comprised 68.9% of the group interviewed. The majority of the respondents were Christian (83.1%). More than half (55.9%) of the mothers had their education up to secondary level with most of them being housewives. Total household income for more than 60% of the respondents was below RM500 per month.

Only 38.4% of the households lived in their own house while 59.3% lived with their parents. The majority of the houses had more than two rooms (84.2%). The houses were mostly supplied with electricity (78.5%) and 87% had water supply but mostly untreated water. The majority of the households had a proper toilet in the house (84.7%) but 15.3% of them had no proper toilets. The details of the respondents are presented in Table 1 and 2.

A total of 20.9% of the children were underweight, 11.9% were stunted and 10.2% were wasted. Most of the children were born with a birth weight of 2.5kg and above (81.9%) with 63.8% having an interval of more than 2 years between siblings. About 69% of the children were breastfed for more than 6 months. A total of 64.4% of the respondents were on complementary feeding at more than six months. More than 50% of the children visited the clinic due to illness once per month. Though the number of hospital admissions remained low, 68% of the admissions were due to respiratory illness. Slightly less than half the parents (45.8%) practised family planning and 65% of the children did not have siblings of less than 5 years of age in the family. The majority of the respondents were household food insecure (89.8%) and individual insecure (85.9%). Only 5.6% of the respondents were food secure. Almost half of the children were reported to have poor appetite and the total calorie intake per day did not meet the RNI. However, in terms of protein intake, 55.4% met the daily recommended nutrient intakes (Table 3).

There was no significant difference in the percentage of malnutrition between the younger (<24.9 months) and older age group (25 months and above). The distribution of cases between girls and boys was quite even for all types of malnutrition. There was also no difference in the relationship between categories of birth intervals. For the duration of breastfeeding, for those identified as stunted, there was a significant relationship between those who were breastfed for less than 6 months and 6 months and above ($p=0.037$). Total calorie and protein intake per day was found to have no significant effect on underweight, wasting and stunting. Of all family factors, only individual insecurity had a significant impact on underweight ($p=0.040$) and wasting ($p=0.028$). As expected, mothers who did not practise any family planning had higher rates of undernourished children. However, significant differences were found only in stunting and wasting. The majority of respondents had access to water and electricity supply. Most of the health care

Table 1 . Socio-demographic characteristics of the participants (N = 177)

	f	*Percentage (%)*	*Mean*	*Standard deviation*	*Range*
Age of the children (months)			31.02	14.26	9 - 60
< 24.9	75	42.4			
25 – 36.9	54	30.5			
37 – 48.9	29	16.4			
49 – 60	19	10.7			
Sex of the child					
Male	82	46.3			
Female	95	53.7			
Race					
Bidayuh	122	68.9			
Iban	25	14.1			
Malay	25	14.1			
Chinese	5	2.9			
Religion					
Christian	147	83.1			
Muslim	26	14.7			
Others	4	2.2			
Mother's age group					
<30	81	45.8			
30-40	75	42.4	30.53	6.61	17 - 47
41-50	21	11.8			
Mother's education					
No education	22	12.4			
Primary education	56	31.6			
Secondary education	99	56.0			
Mother's occupation					
Housewife	163	92.1			
Others (private & Government employee)	14	7.9			
Father's education[a]					
No education	17	9.6			
Primary education	44	24.9			
Secondary education	88	49.7			
Tertiary education	2	1.1			
Father's occupation					
Farmer	104	58.8			
Others (private & Government employee)	47	26.6			
Total family monthly income					
Less than RM500	110	62.1			
RM500 – RM1000	55	31.1			
More than RM1000	12	6.8			

[a] 26 (14.7%) children from a single parent

Table 2. Living conditions of the respondents (N = 177)

	f	*Percentage (%)*
House ownership		
Family house	105	59.3
Own house	68	38.4
Rented house	4	2.3
Type of house		
Brick	119	67.2
Wooden	34	19.2
Mixed (brick & wood)	24	13.6
Number of rooms in the house		
Less than 2 rooms	28	15.8
Two or more rooms	149	84.2
Electricity supply		
Yes	139	78.5
No	38	21.5
Water supply		
Yes	154	87.0
No	23	13.0
Toilet in the house		
Yes	150	84.7
No	27	15.3

Table 3. Child health

	f	*Percentage (%)*
Weight-for-age		
Normal	104	58.8
Mild Underweight	36	20.3
Underweight	37	20.9
Height-for-age		
Normal	127	71.7
Mild Stunting	29	16.4
Stunting	21	11.9
Weight-for-height		
Normal	142	80.2
Mild wasting	17	9.6
Wasting	18	10.2
Birth weight		
<2.5 kg	32	18.1
≥2.5kg	145	81.9
Position of child in the family		
1	49	27.7
2	34	19.2
3	32	18.1
4	27	15.3
5	14	7.9
>5	21	11.8

See next page

Table 3. From previous page

Age interval between immediate siblings		
2 years and less	32	18.1
More than 2 years	113	63.9
Duration of breastfeeding		
No breastfeeding	13	7.3
Less than 6 months	42	23.7
6 months and more	122	69.0
Age on complementary feeding		
Less than 6 months	63	35.6
6 months and more	114	64.4
Frequency of clinic visits due to illness		
Once per week	8	4.5
nce in a fortnight	14	7.9
Once in a month	101	57.1
No	54	30.5
Frequency of hospital admissions for the past one year		
Never	127	71.7
Once	27	15.3
Twice	17	9.6
Thrice	6	3.4
Diagnosis of the admission to the hospital		
Respiratory illness	34	68.0
Gastrointestinal illness	11	22.0
Other illnesses	5	10.0
Mother's perception of child's appetite		
Good	54	30.5
Moderate	39	22.0
Poor	84	47.5
Family planning practised by parents		
Yes	81	45.8
No	96	54.2
Number of siblings less than 5 years in the family[a]		
0	115	65.0
1	54	30.5
2	7	4.0
More than 3	1	0.5
Food secure	10	5.6
Household insecure	159	89.8
Individual insecure	152	85.9
Child hunger	52	29.4
Total calorie intake per day		
Met RNI	83	46.9
Did not meet RNI	94	53.1
Total protein intake per day		
Met RNI	98	55.4
Did not meet RNI	79	44.6

[a]32 (18.1%) of them are from a one-child family; RNI = Recommended Nutrient Intake

facilities could be reached as they are within 10 km radius. Detailed information can be found in Table 4.

Logistic regression analysis was performed on all variables for the three separate malnutrition indicators. For underweight indicators, the full model containing all predictors was statistically significant, chi square = 40.162, p=0.049, df = 27, indicating that the analysis was able to identify the factors influencing underweight among the respondents. This model contained the 20 Independent Variables explaining between 2.34% (Cox and Snell R Square) and 3.14% (Nagelkerke R Square) of the variance in factors influencing underweight among the respondents. Table 5 shows that the birth weight, frequency of clinic visit, and individual insecurity significantly contributed to underweight.

The Odds Ratio or Exp (B) value for birth weight indicates that the respondents' birth weight of less than 2.5kg were 3.4 times more likely to be affected by underweight compared to those with birth weight of 2.5 kg and more. The Odds Ratio or Exp (B) value for the frequency of clinic visits indicates that the respondents who had a frequency of once per week were 42.3 times more likely to be underweight. Individual insecurity was a protective factor for underweight children with the Odds Ratio or Exp (B) value being 0.14. The Wald value also indicated that birth weight, frequency of clinic visit, and individual insecurity significantly contributed to underweight.

As for stunting, the full model containing all predictors was statistically significant with chi square = 40.244, p 0.049, df = 27, indicating that the analysis was able to identify the factors influencing stunting among the respondents. This model contains the 20 Independent Variables explaining between 2.34% (Cox and Snell R Square) and 3.39% (Nagelkerke R Square) of the variance in factors that influenced stunting among the respondents. Table 5 shows that age when complementary feeding was started is a significant factor contributing to stunting. The Odds Ratio or Exp (B) value for age when complementary feeding was started indicates that those children who were introduced to complementary feeding less than 6 months old were 5.5 times more likely to be stunted. The Wald value also indicates that the age of weaning significantly contributed to malnutrition.

For the last indicator – wasting – the full model containing all predictors was not statistically significant as chi square = 34.697, p=0.147, df = 27, indicating that the analysis was not able to identify the factors that influence wasting among the respondents. This model contains the 20 IV explaining between 2.05% (Cox and Snell R Square) and 3.22% (Nagelkerke R Square) of the variance in factors that influence wasting among the respondents. Table 5 shows that family planning practice, individual insecurity and meeting recommended protein intake per day are statistically significant factors contributing to wasting. The Odds Ratio or Exp (B) value for family planning practice indicates that those children from families that did not practice family planning are 5.3 times more likely to experience wasting. Individual insecurity was a protective factor for wasting children with the Odds Ratio or Exp (B) value being 0.13. The Odds Ratio or Exp (B) value for total protein intake per day indicates that the respondents who did not meet the recommended protein intake per day were 4.8 times more likely to have wasting. The Wald value also indicates that the practise of family planning and meeting recommended protein intake per day significantly contributes to malnutrition.

DISCUSSION

In this study, a total of 20.9% were underweight, 11.9% stunted and 10.2% wasted. These figures are higher than the state figures for 2011. Compared with a

Table 4 . The association between individual, family and community factors with malnutrition

Characteristics/variables	*Value label*	*Underweight (n=73)n(%)*	*[a]P value*	*Stunting (n=50)n(%)*	*[a]P value*	*Wasting (n=35)n(%)*	*[a]P value*
INDIVIDUAL FACTORS							
Age (year)	< 24.9	27(36.99)	0.620	25(50.00)	0.580	14(40.00)	0.991
	25 – 36.9	23(31.51)		12(24.00)		11(31.43)	
	37 – 48.9	14(19.32)		8(16.00)		6(17.14)	
	49 - 60	9(12.32)		5(10.00)		4(11.43)	
Gender	Male	38(52.05)	0.200	25(50.00)	0.539	17(48.57)	0.766
	Female	35(47.95)		25(50.00)		18(51.43)	
Birth order	1	18(24.66)	0.753	12(24.00)	0.629	8(22.86)	0.381
	2	14(19.18)		11(22.00)		8(22.86)	
	3	11(15.07)		6(12.00)		5(14.23)	
	4	13(17.80)		8(16.00)		7(20.00)	
	5	6(8.22)		5(10.00)		5(14.23)	
	>5	11(15.07)		8(16.00)		2(5.82)	
Birth weight	<2.5 kg	16(21.92)	0.266	6(12.00)	0.187	8(22.86)	0.412
	≥2.5kg	57(78.08)		44(88.00)		27(77.14)	
Birth interval	2 years and less	14(19.18)	0.678	9(18.00)	1.000	5(14.23)	0.580
	More than 2 years *32(18.1%) of them are the only child in the family, they have no other siblings	48(65.75)		32(64.00)		25(71.43)	
Duration of breastfeeding	Less than 6 months	18(24.66)	0.978	12(24.00)	0.037*	11(31.43)	0.380
	6 months and more *7.3% of them were not breastfed	50(68.50)		37(74.00)		23(65.71)	
Age on complementary feeding	Less than 6 months	29(39.73)	0.592	20(40.00)	0.338	12(34.28)	0.981
	6 months and more	44(60.27)		30(60.00)		23(65.72)	

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Table 4. From previous page

Characteristics/variables	*Value label*	*Underweight (n=73)n(%)*	*[a]P value*	*Stunting (n=50)n(%)*	*[a]P value*	*Wasting (n=35)n(%)*	*[a]P value*
Frequency of clinic visit due to illness	Once per week	6(8.22)	0.179	3(6.00)	0.258	2(5.71)	0.851
	Once in a fortnight	5(6.85)		6(12.00)		3(8.57)	
	Once in a month	39(53.42)		31(62.00)		17(48.57)	
	No visit due to illness	23(31.51)		10(20.00)		13(47.15)	
Hospital Admissions	Yes	22(30.14)	0.640	14(28.00)	0.963	9(25.71)	0.710
	No	51(69.86)		36(72.00)		26(74.29)	
Total calorie intake per day	Meets RNI	36(49.32)	0.588	27(54.00)	0.234	17(48.57)	0.824
	Does not meet RNI	37(50.68)		23(46.00)		18(51.43)	
Total protein intake per day	Meets RNI	45(66.64)	0.159	32(64.00)	0.148	24(62.86)	0.079
	Does not meet RNI	28(38.36)		18(36.00)		11(37.14)	
Child appetite	Good	20(27.40)	0.573	14(28.00)	0.270	12(34.30)	0.314
	Moderate	17(23.30)		12(24.00)		7(20.00)	
	Poor	36(49.30)		24(48.00)		16(45.70)	
FAMILY FACTORS							
Mother's age (year)	<30	30(41.10)	0.568	24(48.00)	0.719	18(51.43)	0.683
	30-40	34(46.58)		19(38.00)		14(40.00)	
	41-50	9(12.33)		7(14.00)		3(8.57)	
Mother's education level	No education	7(9.59)	0.710	5(10.00)	0.672	2(5.71)	0.277
	Primary education	30(41.10)		18(36.00)		14(40.00)	
	Secondary education	36(49.31)		27(54.00)		19(54.29)	
Food secure	Yes	6(8.22)	0.215	2(4.00)	0.551	4(11.43)	0.980
	No	67(91.79)		48(96.00)		31(88.57)	
Household insecure	Yes	63(86.30)	0.193	45(90.00)	0.963	29(82.86)	0.128
	No	10(13.70)		5(10.00)		6(17.14)	
Individual insecure	Yes	58(79.45)	0.040*	42(84.00)	0.653	26(74.29)	0.028*
	No	15(20.55)		8(16.00)		9(25.71)	
Child hunger	Yes	20(27.40)	0.628	14(28.00)	0.801	9(25.71)	0.595
	No	53(72.60)		36(72.00)		26(74.29)	

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Table 4. From previous page

Characteristics/variables	*Value label*	*Underweight (n=73)n(%)*	*[a]P value*	*Stunting (n=50)n(%)*	*[a]P value*	*Wasting (n=35)n(%)*	*[a]P value*
Household size	1 – 5	8(10.96)	0.368	6(12.00)	0.340	2(5.71)	0.773
	6 – 10	54(73.97)		36(72.00)		29(82.86)	
	>10	11(15.07)		8(16.00)		4(11.43)	
Total family income per month	Less than RM500	45(61.64)	0.993	37(74.00)	0.111	20(57.14)	0.319
	RM500 – RM1,000	23(31.51)		10(20.00)		14(40.00)	
	More than RM1,000	5(7.45)		3(6.00)		1(2.86)	
Duration of family planning	Less than 1 year	20(27.40)	0.170	10(20.00)	0.044*	13(37.14)	0.017*
	One year to five years	9(12.33)		6(12.00)		8(22.86)	
	More than five years	5(5.45)		0(0.00)		3(8.57)	
	Not practising FP	39(52.82)		34(68.00)		11(31.43)	
COMMUNITY FACTORS							
Health care accessibility	Less than 5km	38(52.05)	0.153	22(44.00)	0.309	16(45.71)	0.887
	5km to 10 km	24(32.88)		22(44.00)		12(34.29)	
	More than 10 km	11(15.07)		6(12.00)		7(20.00)	
Water supply	Yes	65(89.04)	0.500	45(90.00)	0.457	31(88.57)	0.758
	No	8(10.96)		5(10.00)		4(11.43)	
Electricity supply	Yes	62(84.93)	0.082	42(84.00)	0.266	32(91.43)	0.380
	No	11(15.07)		8(16.00)		3(8.57)	

[a] Based on chi-square test; RNI = Recommended Nutrient Intake;

Table 5 . Logistic regression predicting factors influencing underweight, stunting and wasting

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp (B)*	*95.0% C.I For Exp(B)*	
							Upper	*Lower*
UNDERWEIGHT								
Age								
<24.9 months	.108	.801	.018	1	.893	1.114	.232	5.352
25–36.9 months	.033	.774	.002	1	.967	1.033	.227	4.7081
37–48.9 months	.663	.855	.601	1	.438	1.940	.363	0.366
49-60 months (r)								
Sex								
Boy	.434	.421	1.067	1	.302	1.544	.677	3.521
Girl (r)								
Birth weight								
<2.5kg	1.232	.647	3.626	1	**.049***	3.428	.965	12.184
≥2.5 kg (r)								
Mother's age								
<30yrs	-.261	.820	.101	1	.750	.7702	.154	3.843
30 – 40yrs	.708	.737	.922	1	.337	.029	.479	8.598
41-50 yrs (r)								
Mother's education								
No Education	-1.127	.843	1.787	1	.181	.3241	.062	1.692
Primary	.659	.458	2.065	1	.151	.932	.787	4.745
Secondary(r)								
Birth interval (year)								
≤2 years	-.826	.732	1.271	1	.260	.438	.104	1.840
>2 years (r)								
Breastfeeding[g]								
Yes	-1.226	.891	1.893	1	.169	.293	.051	1.683
No (r)								
Age on complementary feeding								
< 6 Months	1.487	.692	4.618	1	.092	4.425	1.140	17.181
≥6 months (r)								
Child appetite								
Good	-.243	.358	.461	1	.497	.7841	.389	1.581
Moderate	.030	.391	.006	1	.939	.030	.479	2.217
Poor (r)								
Clinic Visit								
Once Per Week	3.745	1.379	7.374	1	**.007***	42.292	2.834	631.033
Once in a fortnight	-.42	.836	.253	1	.615	.656	.127	3.382
Once in a month	-.064	.481	.018	1	.895	.938	.366	2.409
No visit (r)								
Duration of family planning practise								
Yes	.231	.426	.294	1	.587	1.260	.547	2.901
No (r)								
Family income								
<RM 500	-.198	.966	.042	1	.838	.8211	.124	5.449
RM500 To RM1,000	.014	.899	.000	1	.988	.014	.174	5.902
>RM1,000 (r)								

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Household Insecure								
Yes	-.944	1.094	.744	1	.388	.389	.046	3.322
No (r)								
Individual Insecure								
Yes	-1.985	.865	5.260	1	**.022**	.137	.025	.749
No (r)								
Child Hunger								
Yes	.513	.475	1.166	1	.280	1.670	.658	4.233
No (r)								
Food Secure								
Yes	-1.082	1.598	.458	1	.499	.339	.015	7.776
No (r)								
Meets Recommended Calorie Intake								
No	.024	.553	.002	1	.965	1.024	.346	3.030
Yes (r)								
Meets Recommended Protein Intake								
No	.961	.535	3.229	1	.072	2.615	.916	7.463
Yes (r)								
Constant	-.315	1.760	.032	1	.858	.730		
STUNTING								
Age								
<24.9months	.343	.976	.124	1	.725	1.409	.208	9.541
25–36.9months	-.143	.9581	.022	1	.881	.867	.133	5.6671
37–48.9months	.727	.036	.493	1	.483	2.068	.272	5.742
49-60 months (r)								
Sex								
Boy	.373	.501	.556	1	.456	1.453	.544	3.877
Girl (r)								
Birth weight								
<2.5kg	-.369	.696	.281	1	.596	.692	.177	2.704
≥2.5 kg (r)								
Mother's age								
<30 yrs	.086	.904	.009	1	.924	1.090	.185	6.410
30 – 40 yrs	.060	.839	.005	1	.943	1.061	.205	5.493
41-50 yrs (r)								
Mother's education:								
No education	-1.047	1.045	1.003	1	.317	.351	.045	2.724
Primary	.273	.522	.273	1	.602	1.313	.472	3.654
Secondary(r)								
Age interval:								
≤2years	-.927	.791	1.374	1	.241	.396	.084	1.865
> 2 years (r)								
Breastfeeding								
Yes	.211	1.287	.027	1	.870	1.234	.099	15.373
No (r)								
Age on complementary feeding:								
< 6 Months	1.259	.881	2.039	1	**.015**	3.520	.626	19.805

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≥6 months (r)								
Child's appetite								
Good	-.134	.393	.115	1	.734	.8751	.405	1.892
Moderate	.105	.423	.062	1	.803	.111	.405	2.544
Poor (r)								
Clinic visit:								
Once per week	1.697	1.162	2.134	1	.144	5.458	.560	53.204
Once in a fortnight	1.310	.878	2.227	1	.136	3.705	.663	20.692
Once in a month	.557	.572	.949	1	.330	1.745	.569	5.352
No visit (r)								
Duration of family planning practise								
Yes	-.873	.493	3.132	1	.077	.418	.159	1.098
No (r)								
Family income								
<RM 500	-.198	.966	.042	1	.838	.8211	.167	2.886
RM500 to RM1,000	.014	.899	.000	1	.988	.014	.055	11.202
>RM1,000 (r)								
Household insecure								
Yes	-.944	1.094	.744	1	.388	.389	.033	3.339
No (r)								
Individual insecure								
Yes	-1.985	.865	5.260	1	.222	.137	.049	2.172
No (r)								
Child hunger								
Yes	.513	.475	1.166	1	.280	1.670	.315	2.440
No (r)								
Food secure								
Yes	-1.082	1.598	.458	1	.499	.339	.005	9.163
No (r)								
Meets recommended calorie intake								
No	.024	.553	.002	1	.965	1.024	.428	4.837
Yes (r)								
Meets recommended protein intake								
No	.961	.535	3.229	1	.072	2.615	.757	8.607
Yes (r)								
Constant	-.315	1.760	.032	1	.858	.730		
WASTING								
Age								
<24.9 months	-1.136	1.003	1.282	1	.258	.321	.045	2.295
25–36.9 months	-1.244	.989	1.583	1	.208	.288	.042	2.001
37–48.9 months	-.706	1.013	.485	1	.486	.494	.068	3.597
49-60 months (r)								
Sex:								
Boy	.030	.528	.003	1	.955	1.030	.366	2.902
Girl (r)								
Birth weight								
<2.5kg	.255	.785	.105	1	.746	1.290	.277	6.013
>2.5 kg (r)								
Mother's age								
<30 yrs	1.132	1.188	.908	1	.341	2.362	.302	31.871

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30 – 40yrs	.860	1.090	.622	1	.430	3.103	.279	20.011
41-50 yrs (r)								
Mother's education								
No education	-.349	1.024	.116	1	.733	.7051		
Primary	.466	.575	.655	1	.418	.593		
Secondary (r)								
Age interval:								
≤2 years	-1.305	1.011		1.667	1	.197	.271	
> 2 years (r)								
Breastfeeding								
Yes	.054	1.386		.002	1	.969	1.055	
No (r)								
Age on complementary feeding:								
< 6 Months	-.001	.853		.000	1	.999	.999	
≥6 months (r)								
Child's appetite								
Good	.194	.429		.204	1	.651	1.214	
Moderate	-.073	.501		.021	1	.884	.930	
Poor (r)								
Clinic visit:								
Once per week	1.186	1.142		1.080	1	.299	3.274	
Once in a fortnight	-.095	1.000		.009	1	.924	.910	
Once in a month	-.157	.597		.069	1	.793	.855	
No visit (r)								
Duration of family planning practise								
Yes	1.666	.574		8.419	1	**.004***	5.290	
No (r)								
Family								
<RM 500	2.083	1.630		2.453	1	.201	8.030	
RM500 to RM1,000	2.459	1.570		1.633	1	.117	11.698	
>RM1,000 (r)								
Household insecure								
Yes	.501	1.670		.090	1	.764	1.650	
No (r)								
Individual insecure								
Yes	-2.059	1.020		4.079	1	**.043***	.128	
No (r)								
Child hunger								
Yes	-.024	.625		.002	1	.969	.976	
No (r)								
Food secure								
Yes	.719	2.038		.124	1	.724	2.052	
No (r)								
Meets recommended calorie intake								
No	-.454	.707		.412	1	.521	.635	
Yes (r)								
Meets recommended protein intake								
No	1.558	.704		4.896	1	**.027***	4.751	
Yes (r)								
Constant	-3.167	2.710		1.365	1	.243	.042	

r=reference group, *Significant at $p<0.05$

previous study done in rural Sarawak by Kiyu *et al*. (1991), this finding indicates that there is an improvement in health status that may be due to substantial progress in poverty eradication, socio-economic development and health care services in the past few decades. Nevertheless, there are still families and villagers who are generally low in socio-economic status, with poor environmental sanitation and low education levels in the rural areas (MOH, 2008). An earlier study by Yap (1985) found a positive significant relationship between child growth and mother's education level. The study also reported that the majority of the parents in villages in Serian district only had an average of between 3 to 4 years of schooling which explains their low household income. Until now, this low socio-economic issue still prevails. This community is still low in socio-economic status with more than half of them having a total household income of less than RM500 per month (62.1%).

The finding of this study indicates that a higher proportion of children with stunting were breastfed more than six months. Though breastfeeding is recommended for children up to one year, complementary feeding should be introduced when the child reaches six months. Prolonged breastfeeding without adequate complementary feeding may increase the risk of malnutrition among children. This is evidenced by studies done previously (Belkeziz *et al.*, 2000; Victora, de Onis & Hallal, 2010; Rao *et al.*, 2005).

Following multiple logistics regression analysis for the three malnutrition indicators (underweight, stunting and wasting),the contributory factors were found to be birth weight, frequency of clinic visit, individual insecurity, age on complementary feeding, duration of family planning practice, and whether they had met RNI of protein.

Low birth weight (LBW), defined as birth weight of 2500 g and below, remains a significant public health problem in many parts of the world especially in developing countries and is associated with a range of both short- and long-term adverse consequences. Based on Ramakrishnan *et al*. (2004), the latest regional estimates of LBW ranges from 25% in South Asia, (where more than one-half of the world's LBW infants are born) to 10% and 12% in Sub-Saharan Africa and Latin America, respectively. It has been further reported that poor nutrition, both before and during pregnancy, is recognised as an important cause. Low birth weight indicates that the infant was malnourished in the womb and/or that the mother was malnourished during her own infancy, childhood, adolescence, and pregnancy. The proportion of babies born with low birth weight therefore reflects the condition of women, and particularly their health and nutrition, not only during pregnancy but the entire lives from childhood to adulthood. Other causes of LBW include environmental factors such as smoking, indoor air pollution, and infections, such as malaria. Underlying social factors such as poverty and women's status are also important, especially in South Asia where more than one-half of the world's LBW infants were born. Kurup & Khandekar (2004) found that low birth weight (odds ratio [OR] 2.32; confidence intervals [CI] 95% 1.61-3.33), higher birth order (OR 1.04; CI 95% 1.01-1.08) and siblings with a history of underweight [OR 1.79 (CI 95% 0.97- 3.28)] were significant predictors of protein-energy malnutrition (PEM). An earlier study in Zimbabwe done by Madzingira (1995) showed that the nutritional status of a child is determined by a variety of factors with one of them being low birth weight.

Studies have shown that underweight and stunting are much higher among children with frequent exposure to illnesses and infections (Wagstaf *et al.*, 2004). A combination of disease and malnutrition weakens the metabolism, forming a vicious cycle of infection and undernourishment, leading to vulnerability to illness

(Ramakrishnan, 2002). The study findings indicate that underweight children were more likely to visit the clinic at least once a week.

WHO (2003) recommends starting complementary feeding at the age of 6 months. In this study, it was found that 64.4% of the children started on weaning food at the age of six months and above. In rural areas of Sarawak, the introduction of weaning and child care practice can also lead to more malnourished children. The majority of the respondents for this study are drawn from the Bidayuh community. Though the mothers are housewives, they are also paddy planters who work in the fields so as to help their husband provide food for the family. Most of the time the children are taken care of by their grandmothers or older siblings and are not fed with the right weaning food.

Khattak *et al*. (2007) found that complementary feeding is affected by mothers' awareness regarding nutrition of their children which can be further improved with basic health education, awareness and proper counselling by the health workers. A recent study in Bangladesh by Niger *et al.* (2010) found that about one-fifth of the respondents said that they did not cook especially for infants but were instead given normal adult meals. This might not be appropriate for the children and the study also they found that more than 50% of the infants were disinterested in their weaning food. In some cases, food such as rice (as the staple food) was diluted with water or soup to facilitate the feeding process (Cheah *et al.*, 2012). The timing of introducing complementary food is important because it should meet the optimal nutrient requirements of the child. Infants who are given complementary food too early may not breastfeed vigorously because they might find solid food more satisfying. On the other hand, infants who are given complementary food later may get less nutrients than recommended based on their physiological need.

The duration of family planning of less than one year is one of the predicting factors that influence wasting. It is well known that the practice and duration of family planning affects the birth interval of the children. Cheah *et al*. (2012) reported that most of the malnourished cases are from large families with close birth intervals. However, in this study, most of the children were from birth intervals of two years and more. Longer birth intervals is very important as mothers must be healthy enough to conceive and take better care of the next child.

Food security creates one possible pathway in determining human nutritional status. There is extensive literature explaining the relationship between poverty, household food security and nutrition (Smith & Haddad, 2000; Zalilah & Ang, 2001; Frankenberger, 1996). Food secured families would be able to provide sufficient, and nutritious food to the family. Inability to do so would lead to a risk of their children being malnourished. In this study, individual insecurity was found to be a significant factor contributing to malnutrition. This finding is in contrast with the study done by Aflah (2006) in Kelantan where poverty was found to affect household food insecurity which in turn affected the nutritional status of the children in the family. Individual insecurity as defined by Radimer *et al*. (1992) is inadequate food intake (quality and quantity) of an adult as a result of shortage of household food. Only when food insecurity in the household is in its most severe form does child hunger exist and affect the nutritional status of the children directly. Though the adults in this study were affected by shortage of food at home, the children were given a minimum acceptable diet. This is supported by a study done in Nepal (Osei *et al.*, 2010) where despite a high prevalence of food insecurity in the study area, the mothers were able to provide

a minimum acceptable diet based on their education and knowledge on optimal nutritional practices. The mothers may adopt certain coping strategies that may indirectly sacrifice the quantity and quality of their diets in order to preserve the amount and quality of food available to their children (Zalilah & Ang, 2001). Thus, a significant relationship was not found between food security and nutritional status of children.

Unlike a previous study by Noorhayati *et al.* (1997) which indicated that protein intake below recommended nutrient intake was not a risk factor for malnutrition, this study found that children who did not meet the recommended protein intake were 4.75 times more likely to be wasted compared to those who did. Wasting is reflected by a low body mass relative to age resulting from acute starvation and disease. Wasting also indicates a recent change in nutritional status related to a sudden deprivation of food or a negative reaction to nutritive substances that result in rapid loss of weight. This study reports the prevalence of wasting to be 10.2% among the children, an alarming figure that should be of concern. The diet of children needs to meet the recommended calorie intake for good physical and mental development. Failure to meet the recommended nutrient intake puts the children at a higher risk of malnutrition and illnesses. This is reflected in the underweight category where children who visited the clinic once per week were more likely to be underweight compared to those who did not. Nevertheless, the frequency of hospital admission was low. This is probably due to the availability and accessibility of health care in the vicinity of their residence which can treat and detect illness early without the need for hospital admission.

The findings of this study did not support the link between some of the key determinants such as household income, mother's education and malnutrition, in contrast to the literature. One possible explanation is that this sample is a homogenous population with a similar socio-economic background where the majority of the parents work as farmers, have lower educational qualifications and a monthly household income of below RM500 (approximately USD162).

As the study focused on Serian District, findings from this study can only be generalised to other areas that have the same characteristics. Moreover, the findings only relate to children who sought healthcare at the government clinics located at the study sites. Nevertheless, the majority of the children were treated and followed up at the clinics because of accessibility and affordability.

CONCLUSION

Based on the findings of this study, it is concluded that malnutrition is still a public health problem in Serian District in Sarawak and the prevalence of malnutrition here is higher than the national and state levels. The study indicates that the majority of the underlying contributing factors to malnutrition in children were manifested at an individual level – low birth weight, frequency of clinic visit, age on complementary feeding, and protein intake below recommended nutrient intake. At family level, only individual insecurity and duration of family planning practice were found to be significant predictors. It is noted that the majority of the mothers were full time housewives who worked in the farm. They might not have enough time to take care of their children and this responsibility may been entrusted to elder children or grand-parents, compromising the quality of child care. Though the government has initiated many rehabilitation programmes for the poor in the rural communities (for example, e-KASIH, food basket programme), reducing malnutrition among children is still a

challenge. What is needed is an overall improvement in living standards.

Conflict of Interest

The authors have no potential conflict of interest to declare.

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