NUTRITIONAL STATUS OF ORANG ASLI CHILDREN IN SUNGAI BERUA, TERENGGANU

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Abstract: This study aimed to determine the nutritional status of Orang Asli children in Sekolah Kebangsaan (SK) Sungai Berua, Kuala Berang, Terengganu, Malaysia. Participants included 77 school children aged between 7 and 12 years, consisting of 38 boys and 39 girls. The methods used to determine the children's nutritional status included anthropometric measurements, biochemical analysis for hemoglobin and urinalysis, as well as urinary iodine determination. Using World Health Organization (WHO) reference standards, it was found that 32.4% of the respondents were underweight, 9.9% severely underweight, 35.2% stunted, and 40.8% severely stunted. The Body Mass Index (BMI)-for-age also indicated that 8.5% of the respondents were "wasted" and 8.5% were "severely wasted". Overall, the mean hemoglobin of the children was 10.6 g/dL and the median of urinary iodine concentration was 131.3 µg/L. Iodine deficiency was widespread among Orang Asli children, with 40.3% of children showing low urinary iodine levels. Hemoglobin had a significant correlation with BMI ($r = 0.310$, $p < 0.05$). The present study shows that underweight, stunting, wasting, anemia and iodine deficiency are still widespread among Orang Asli children. Nutrition and health intervention is needed to reduce these risks.

Keywords: Nutritional status, Orang Asli, children, malnutrition.

Introduction

Undernutrition is a life-threatening health problem found predominantly among communities living in unfavorable conditions, these communities include the Orang Asli. In Malaysia, malnutrition has been prevalent among Orang Asli children for decades, especially in remote areas (United Nations Development Programme [UNDP], 2016). Although the Malaysian government has made efforts to improve their lives, the health of the Orang Asli in Peninsular Malaysia remains poor.

They live predominantly in remote jungles, lowlands and coastal areas and are very dependent on natural resources for sustenance. They have been marked as the poorest of the poor, and their household income is far below the baseline indicated by the United Nations Millennium Development Goals 2015 (UNDP, 2016). Poverty is the leading factor of malnourishment contributing to child mortality (WHO, 2016) and in accordance with that report,

one of United Nations Millennium Development Goal set in 2015 was the reduction of child mortality (UNDP, 2016). As reported by World Health Organization (WHO, 2016), 5.9 million children under the age of five years died in 2015, this represents nearly 16,000 deaths daily. Over one-third of child mortality cases that occur in low-income countries is caused by malnutrition. Poor nutrition not only influences cognitive development (Frisvold, 2015; Zhang *et al*., 2010) and the immune system (Marques *et al*., 2013), but also indirectly leads to emotional and psychological problems (Walker *et al*., 2007). Malnourished children are often susceptible to problems such as iron deficiency anemia, being severely underweight, stunting, wasting, iodine deficiency and infection (Eze *et al*., 2017). Recently, a study reported that some socio-demographic factors including father's educational and income, hemoglobin status, infections and environment are responsible in affecting Orang Asli's children cognitive performance (Murtaza *et al*., 2019).

The Orang Asli around Kenyir Lake, a well-known tourist spot in Terengganu, Malaysia were moved to an Orang Asli resettlement area near the lake called Kampung Sungai Berua. Kampung Sungai Berua is located about 32km from Pengkalan Gawi and 9km from Sungai Como (Jabatan Kemajuan Orang Asli [JAKAO], 2015). This Orang Asli resettlement area was established by Jabatan Hal Ehwal Orang Asli (JHEOA) in 1977. Sekolah Kebangsaan Sungai Berua is the primary school located in the village. The residents of the village were moved from the National Park around Kenyir Lake a few decades ago. The displacement of Orang Asli is considered beneficial to the community, as it improved their economy, access to education, and overall lifestyle (Zahari et al., 2014).

Few studies have been conducted among Orang Asli children as compared with children of other ethnicities. Previous research on the nutritional status of the Orang Asli was carried out in Kelantan, Perak, Selangor, and Pahang (Mian & Leng, 1998; Zulkifli et al., 1999; Yusof et al., 2007; Haemamalar et al., 2010). These studies varied broadly in terms of their emphasis, encompassing everything from malnutrition, malaria, filariasis and microbial infections. Some of these studies focused on food security (Nurfahilin & Norhasmah, 2015; Wong et al., 2015) and micronutrients (Osman, 2000; Ismail et al., 2009). Several studies have also drawn attention to soil-transmitted helminthiasis among Orang Asli children (Ngui et al., 2012; Al-Delaimy et al., 2014).

Studies have also found infections associated with malnutrition, especially stunting and wasting. Many studies have shown that being underweight and being stunted are widespread among Orang Asli children in Malaysia (Lin, 1988; Zalilah & Tham, 2002; Aini et al., 2007). Nevertheless, to date, no study have been carried out to assess the nutritional status of Orang Asli children in Terengganu.

Therefore, the present study aims to determine nutritional status by anthropometric measurements and biochemical assessments among Orang Asli children at SK Sungai Berua, as well as identify the interrelationship between anthropometric measurements, hemoglobin concentration, urinalysis, and urinary iodine concentration.

Materials and Methods

A cross-sectional study was conducted in SK Sungai Berua. There are three Orang Asli settlements in the state of Terengganu: Sungai Berua, Hulu Terengganu; Sungai Pergam, Kemaman and Sungai Sayap, Besut (Jabatan Kemajuan Orang Asli [JAKOA], 2015). Hulu Terengganu is a rural area in Terengganu. This area became more populated after the building of a hydroelectric dam on Kenyir Lake. For this study, the Kampung Sungai Berua which is located 5km from Kenyir Lake was selected as the study location, as this is the only Orang Asli resettlement area in Hulu Terengganu. There are two main Orang Asli ethnicities in the village: the Semoq Beri and Batek. The Orang Asli children study at SK Sungai Berua, a primary school located in Kampung Sungai Berua. Based on records at the school, 96 school-aged children are currently studying at SK Sungai Berua (Mohd Noor, 2016).

Thus, the school was the locus for the collection of data. Figure 1 shows the location of the study.
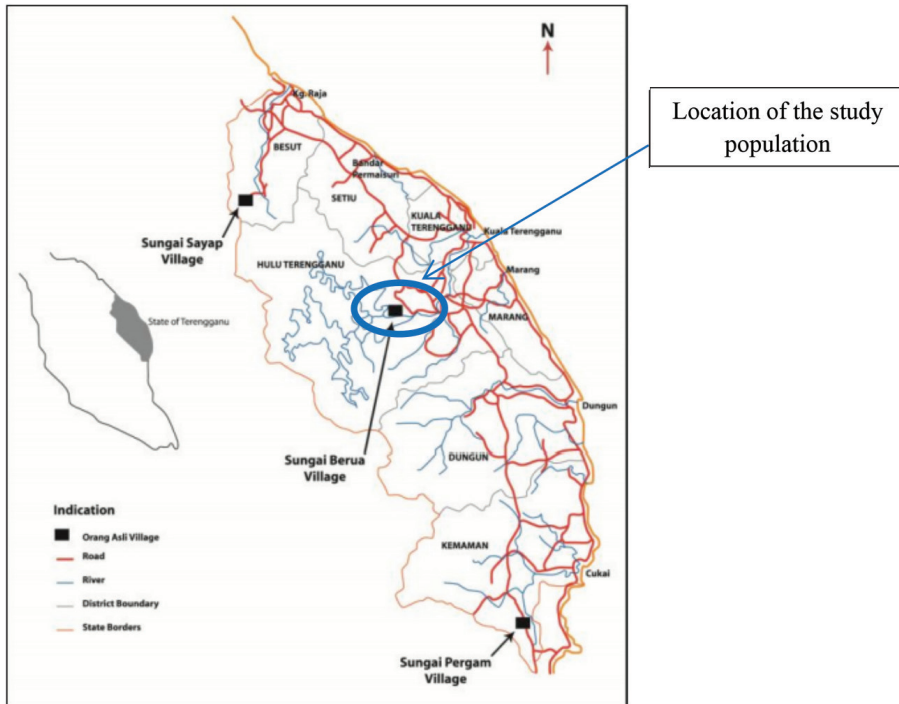
Subjects

Initially, all students aged between 7 and 12 years from SK Sungai Berua were invited to participate in this study on a voluntary participation basis.

Using the standard formula, a sample size of 77 respondents was required for a 95% confidence interval and a margin of error of 5%.

$$\text{Sample size} = \frac{\frac{z^2 \, x \, p(1-p)}{e^2}}{1+(\frac{z^2 x p(1-p)}{e^2 N})} \, ,$$

where N = population size
z = z-score
e = margin of error
p = standard deviation

$$\text{Sample size} = \frac{\frac{1.96^2 \, x \, 0.5(1-0.5)}{0.05^2}}{1+(\frac{1.96^2 x \, 0.5(1-0.5)}{0.05^2(96)})}$$

$$= 76.83 \approx 77$$

Anthropometric Measurements

Body weight and body fat were measured without shoes and socks using a Tanita digital body fat scale UM-02 (Tanita, UK) to the nearest 0.1kg. Height was taken to the nearest 0.1cm by the SECA stadiometer. BMI was calculated using weight and height. The collected anthropometric data was further classified using WHO growth references for children between 5 and 19 years of age. WHO AnthroPlus version 1.0.3 software was utilised to determine the z-scores for height-for-age and BMI-for-age. This score was further used to classify children as normal, stunted; underweight, normal and overweight, respectively.

Biochemical Assessments

Hemoglobin concentration was measured using finger prick test and analyzed on the spot using HemoCue® 201 a handheld hemoglobin photometer. Urinalysis was performed using a portable urine analyzer. Urine was collected using a specimen cup. The urine test strip (AKRKAY AUTION Sticks 10 EA) was dipped

into the urine and placed into the urine analyzer. Urine Analyzer PocketChem ™ UA PU-4010 was used to determine the presence of red blood cells, glucose, protein, ketones, bilirubin, and the pH of urine. For urinary iodine analysis, the modified micro method was used to evaluate the concentration of urinary iodine based on *Sandell-Kolthoff* reaction.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS, version 20.0) for Windows. Student's t-test and Mann-Whitney U-test were used to compare the outcomes between genders. Spearman's correlation tests were used to determine the relationship between anthropometric measurements and biochemical assessments. In all analysis, the significance level was set at $p < 0.05$.

Results

Demographic Characteristics

Seventy-seven students (38 boys and 39 girls) aged between 7 and 12 years participated in this study. All of the respondents in this study were from Batek tribe. Table 1 shows the demographic characteristics of the respondents.

Anthropometry

The anthropometric measurements of the respondents are shown in Table 2. The mean height and weight were 125.8cm and 23.1kg, respectively. The mean height of girls was higher than boys (t = -0.209, p < 0.05) perhaps because more girls (n = 21) than boys (n = 12) aged between 10 and 12 years joined the study. The mean BMI of children was 14.3 kg/m², falling within the normal range. The mean body fat of respondents was $11.3 \pm 4.0\%$, indicating that the majority of the respondents were underfat. There were no significant differences in weight, BMI and body fat between boys and girls.

Based on the WHO reference standard, the present study found that 32.4% of the children were underweight, 9.9% severely underweight, 35.2% stunted and 40.8% severely stunted. Furthermore, their BMI-for-age also demonstrated that 8.5% of the respondents were wasted and or severely wasted

Risk of anemia

Table 3 indicates the risk of anemia among children. The overall hemoglobin concentration for children was only 10.6 g/dL, in the range of 5.7 to 14.9 g/dL, with median 10.9 g/dL for boys and mean 10.7 g/dL for girls, respectively. Most of the children (> 60%) suffered from moderate anemia (8.0-10.9 g/dL).

Table 1: Demographic characteristics of the respondents

Indicators	Frequency (n = 77)	Percentage (%)
Gender		
Boys	38	49.5
Girls	39	50.6
Age (years)		
7	12	15.6
8	12	15.6
9	19	24.7
10	17	22.1
11	5	6.5
12	12	15.6
Race		
Batek	77	100

Table 2: Anthropometric measurements and body weight of the respondents

Parameter	Overall		Boys (*n* = 38)		Girls (*n* = 39)		t-value/ z-value	*P* value
	Mean / Median	Range	Mean / Median	Range	Mean / Median	Range		
Height (cm)	125.76 ± 9.89	101.50 - 148.50	123.43 ± 8.94	101.50 - 143.50	128.03 ± 10.35	110.20 - 148.50	t = -2.09	0.04*
Weight (kg)	23.12 ± 6.64	12.60 - 45.00	21.40 (6.00)	12.60 - 38.80	21.40 (7.40)	15.50 - 45.00	z = -1.08	0.280
BMI (kg/ m²)	14.32 ± 2.01	10.91 - 21.45	13.83 (1.73)	10.91 - 21.45	13.73 (2.68)	11.68 - 20.41	z = -0.392	0.695
Body fat (%)	11.30 ± 4.03	5.90 - 24.10	10.59 ± 3.57	7.70 - 22.70	10.80 (7.10)	5.90 - 24.10	z = -1.075	0.282

Ht-for-age	Overall, n (%)	Boys, n (%)	Girls, n (%)
Normal	48 (62.3)	24 (63.2)	24 (61.5)
Stunted	29 (37.7)	14 (38.8)	15 (38.5)
BMI-for-age			
Underweight	37 (48.1)	17 (44.7)	20 (51.3)
Normal	39 (50.6)	20 (52.7)	19 (48.7)
Overweight	1 (1.3)	1 (2.6)	-

Data are presented as mean ± SD or as median (IQR); *significantly difference between genders by Independent t-test

Table 3: Risk of anemia among the respondents

Indicators	Number (n)	Hemoglobin concentration (g/dL)	Range (g/dL)
Overall	(n = 73)	10.60 ± 1.93	5.70 - 14.90
Normal	28	38.4	
Anemic	45	61.6	
Boys	(n = 37)	10.90 (2.30)	5.70 - 13.70
Normal	15	40.5	
Anemic	22	59.5	
Girls	(n = 36)	10.66 ± 1.88	6.50 - 14.90
Normal	13	36.1	
Anemic	23	63.9	

Data are presented as mean ± SD / median (IQR).

Urinalysis

Urinalysis of children is described in Table 4. The findings revealed that 55.6% had hematuria and 37.5% had abnormal leukocyte *esterase*. The median pH of urine was 5.5, while the median urinary specific gravity was 1.020. The overall results of urinalysis showed that the prevalence risk of infection was high in Orang Asli children. A majority of the children showed positive leukocyte *esterase* and blood in the urine.

Urinary Iodine

The overall mean urinary iodine concentration of children was 131.32 µg/L, which falls within the normal range. This means that many of the

children in the study have an adequate iodine intake. Mann-Whitney U-test shows that there was no significant difference between genders. Based on the urinary iodine classification of less than 100 ug/L to indicate insufficient iodine intake (De Benoist *et al.,* 2004), the present study found that 40.3% of respondents (n=29) suffered from iodine deficiency. Table 5 shows the urinary iodine concentration of the respondents between genders and its category.

Discussion

There were no significant differences in weight, BMI, and body fat between boys and girls.

However, there is a significant difference between the heights of boys and girls (t = -0.29, $p < 0.05$). Boys and girls showed similar weights, which is in accordance to Bong *et al.* (2012) that only as they grow older into puberty do boys tend to be taller and heavier than girls. A majority of Orang Asli children do not follow normal growth patterns as shown in WHO growth charts as compared to children in the United States, Ghana, India, Norway, Brazil, and Oman, as indicated by Onis *et al.* (2007). The growth patterns of children may greatly differ. Generally, children experience physical growth during childhood, and weight and height changes rapidly (Ceelen *et al.*, 2009).

Table 4: Results of urinalysis

Parameter	Overall		Boys		Girls	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Glucose						
Normal	71	98.6	36	100.0	35	97.2
Abnormal	1	1.4	0	0.0	1	2.8
Ketone						
Normal	70	97.2	34	94.4	36	100.0
Abnormal	2	2.8	2	5.6	0	0.0
Blood						
Normal	40	55.6	21	58.3	19	52.8
Abnormal	32	44.4	15	41.7	17	47.2
Protein						
Normal	72	100.0	36	100.0	36	100.0
Abnormal	0	0.0	0	0.0	0	0.0
Leukocyte						
Normal	45	62.5	27	75.0	18	50.0
Abnormal	27	37.5	9	25.0	18	50.0
Bilirubin						
Normal	69	95.8	35	97.2	34	94.4
Abnormal	3	4.2	1	2.8	2	5.6
Urobilinogen						
Normal	63	87.5	32	88.9	31	86.1
Abnormal	9	12.5	4	11.1	5	13.9
Nitrite						
Normal	71	98.6	36	100.0	35	97.2
Abnormal	1	1.4	0	0.0	1	2.8
pH	5.50 (0.50)		5.5 (0.00)		5.50 (0.50)	
Specific gravity	1.020 (0.10)		1.020 (0.009)		1.020 (0.10)	

Table 5: Urinary iodine concentration of the respondents

Gender	Number (n)	Urinary Iodine Concentration (µg/L)	Range (µg/L)
Overall	72	131.32 (63.03)	8 – 328
Boys	36	127.69 ± 69.74	8 – 328
Girls	36	134.94 (56.29)	55 - 316
Urinary iodine (ug/L)	**Number (n)**	**Iodine intake status**	**Iodine status**
<20	1	Insufficient	Severe iodine deficiency
20-49	2	Insufficient	Moderate iodine deficiency
50-99	26	Insufficient	Mild iodine deficiency
100-199	34	Adequate requirement	Adequate iodine
200-299	7	Above requirement	At risk of iodine induced-hyperthyrodism
>300	2	Excessive	Risk of adverse health consequences

Overall, the mean BMI for both genders among the children in the study were categorised as normal. The way the BMI is interpreted is age and gender specific for children as the amount of body fat changes with age and varies with gender as the child grows (Chung, 2015). Thus, the calculated BMI values were further analysed using a BMI-for-age percentile chart.

These findings show that malnutrition persists among Orang Asli children aged between 7 and 12 years. The prevalence of underweight and stunted children is high. The nutritional status of Orang Asli children has remained poor since the 1980's. Some of the present findings are similar to trends in other locations in Malaysia, as being underweight and stunted remains widespread in certain areas among Orang Asli children (Lin, 1988; Zalilah *et al*., 2002; Aini *et al*., 2007; Yusof *et al*., 2007; Zainuddin *et al*., 2013).

The present findings are consistent with an earlier study among Semai Orang Asli school children in Perak. Almost 30 years ago, it was found that 51% boys and 46% of girls were underweight. Stunting was found in 71% of boys and 65% of girls (Lin, 1988).

Comparatively, the present findings describe more cases of underweight and stunting among boys over girls. This may be because boys are more likely to be affected by environmental stress than girls, resulting in stunted growth (Olack *et al*., 2011).

Wong *et al*. (2016) documented that more than 50% of Orang Asli children in Pos Legap, Perak were underweight and over 30% of children still stunted. Furthermore, it was reported that the poor nutritional status of Orang Asli children was probably due to a soil-transmitted helminth (STH) infection, since the majority of children were infected. However, stool examinations were not conducted in the present study; as a result, infection cannot be ruled out as one of the predicted factors of malnutrition in Orang Asli children in SK Sungai Berua.

More girls than boys were classed as "underweight" as shown in Table 2. This may be explained by gender disparities in Orang Asli families. Girls may suffer from unequal access to quality food (Ramchandran, 2014). In addition, different childcare practices with reference to boys and girls in the family might also be a reason behind differing nutritional outcomes (Vlassoff, 2007). Poor nutritional status among Orang Asli children was shown since the percentage of underweight and stunting for both genders remain high (approximately between 40% and 50%) over the last three decades (Lin *et al*., 1988; Zulkifli *et al*., 1999; Shariff *et al*., 2000; Al-Mekhlafi *et al*., 2008; Wong *et al*., 2016).

Additionally, Shariff *et al*. (2000) revealed that regardless of ethnicity or location, rates of underweight in boys and girls were around 55% and 49%, respectively. Furthermore, their study reported that 50% of boys and 47% girls experience stunting. Rates of malnutrition were almost similar to the present findings that 51% of girls and 45% of boys were underweight, and 38.8% of boys and 38.5% of girls were stunted. However, in that study more Orang Asli boys were stunted as compared to the present study.

Again, regardless of ethnicity and study location, the nutritional statuses of children in Kuala Lumpur and the present study are similar. Thus, it is suggested that one of the factors contributing to malnutrition in children is the socio-economic status of the household, rather than ethnicity.

Widespread malnutrition among Orang Asli children might be influenced by inadequacy of energy intake to support growth and development. It is well known that unavailability of fresh food leads to inadequate nutrient and energy intake for children who live in rural areas (Pollard *et al*., 2014). The distance between Kampung Sungai Berua to the nearest town is around 20km, but due to the lack of a public transportation system, most residents rarely travel to town in order to obtain fresh food, as they do not have their own vehicles. The poor health status of Orang Asli children might also be related to infection.

An earlier study by Norhayati *et al*. (1997) among Orang Asli children reported a high prevalence of infection including *Trichuasis* (63%), *Ascariasis* (92%) and hookworm (30%), though decreases were found in overall prevalence rates in Malaysia. Recently, a study of Orang Asli children in Negeri Sembilan reported that 35% had parasitic infections with 58% infected with *Trichuris trichiuria*, 11% with *Ascaris lumbricoides* and 36% by both parasites (Murtaza *et al*., 2019).

In terms of biochemical assessment, the mean hemoglobin concentration for Orang Asli children in the present study is low as compared to previous studies (Aini *et al*.,

2007; Al-Mekhlafi *et al*., 2008; Ahmed *et al*., 2012). Generally, anemia among children is caused by insufficient intake of iron, folate, and vitamin B-12 in the diet (WHO, 2015). In the present study, there were more anemic Orang Asli children at younger ages, which may be because the overall nutrition of children was not met. Anemia cases among Orang Asli might also be high due to parasitic infections, hemoglobinopathies, and a lack of sufficient dietary iron. Thus, Orang Asli children are most susceptible to being underweight, stunted and suffering from anemia.

The varying prevalence of anemia in different study locations is likely due to the inaccessibility to food. As indicated by WHO (2001), the meal pattern of Southeast Asians is low in protein and iron. A poor iron intake, together with poverty and infections, could be a contributing factor of anemia and iron deficiency anemia (IDD) among children in remote areas. Apart from that, Aini *et al*. (2007) found that the severe *trichurisiasis* was significantly associated with anemia.

Previous studies also identified hookworm infection as a strong predictor of IDA and low socioeconomic status, also influencing dietary iron intake among children (Ngui *et al*., 2012).

As indicated by the urinalysis results, the present study suggested a high risk of infection among the children. Infection might be a consequence of practices such as drinking non-boiled water. Soil-transmitted helminths might occur because most Orang Asli children remain barefoot at home, with some also not wearing shoes during school time.

Thus, poor nutritional status of Orang Asli children may be caused by soil-transmitted helminth infection, as reported in several previous studies (Ahmed *et al*., 2012; Al-Mekhlafi *et al*., 2013; Al-Delaimy *et al*., 2014; Wong *et al*., 2016).

Interestingly, Orang Asli children in the present study have slightly higher urinary iodine concentrations than most other locations in Malaysia except Sabah (Selamat *et al*., 2010).

This might be due to the availability of iodine rich food sources from fresh fish in Banding Lake, since the most important reservoir of iodine is in the soil that runs into the lake's water. It is thus easier for children to get iodine rich foods, resulting in higher frequency of iodine food consumption and lowering the risk of iodine deficiency.

In the present study, Spearman's correlation tests indicate a weak relationship between hemoglobin with BMI (r= 0.310, p= 0.008). A preliminary study in Japan also reported a positive association between hemoglobin levels and BMI (Shimizu *et al*., 2014). Individuals with abnormal BMI might have a higher risk of iron deficiency anemia and iron deficiency than individuals with desirable BMI (Keikhaei *et al*., 2012). This is because hemoglobin concentration increases with BMI as children get sufficient nutrition for growth and build more hemoglobin. Thurlow (2006) supported the present findings, as no association was observed between urinary iodine levels and biochemical iron indices among school children in Thailand. Thus, hemoglobin concentrations might not affect urinary iodine concentration. Furthermore, the present findings show no significant relationship between body fat and hemoglobin concentration. In contrast, Moschonis *et al*. (2012) revealed that the percentage of body fat and visceral fat mass were positively associated with iron deficiency in schoolchildren in Greece. The variation of results might be due to that there was no obese child found in the Orang Asli population and most children were underweight.

Conclusion

The overall nutritional status of Orang Asli children in SK Sungai Berua was found to be poor. The poor nutritional status of Orang Asli children might be influenced by their poor socio-economic status, environmental factors, and infections which all affect their nutrient intakes, immunity, and health status. Although the government has gradually improved the socioeconomic status, educational standards and health facilities in the Orang Asli settlements, much more can still be done. If children are given a more conducive environment, they might experience better growth.

Acknowledgements

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