



UNIVERSITI PUTRA MALAYSIA

**FACTORS ASSOCIATED WITH GROWTH STATUS OF ORANG ASLI
CHILDREN IN TEMERLOH, PAHANG, MALAYSIA**

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By

WONG CHEE YEN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Philosophy**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

FACTORS ASSOCIATED WITH GROWTH STATUS OF ORANG ASLI CHILDREN IN TEMERLOH, PAHANG, MALAYSIA

By

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Chair : Zalilah Mohd Shariff, PhD
Faculty : Medicine and Health Sciences

Undernutrition continues to be the primary public health problem in *Orang Asli* (OA) children of Peninsular Malaysia. Most studies of undernutrition and its associated factors among indigenous children have been cross-sectional, but the relevance evidence from longitudinal studies is limited. The main objective of this study is to determine the factors associated with growth status of OA children in Temerloh, Pahang, and this study consisted of two phases. The first phase was a cross-sectional study ($N=304$) to determine the prevalence of undernutrition among children aged <5 years in 11 selected OA villages surrounding the Krau Wildlife Reserve, in Temerloh district of Pahang. The findings of the Phase 1 were used to support the implementation of the subsequent study, which was a 2-year prospective cohort study ($N=214$) to identify the pattern and timing of growth in children (aged ≤ 3 years) and its associated factors from seven selected *Jah Hut* villages in Temerloh district of Pahang.

In the Phase 1 study, information was obtained from parents on household demographic and socio-economic, and child characteristics. Weight and length/height of children were also measured. Majority of children in this study were *Jah Hut* (86.4%) and living in poor households (75.9%). About 25% of children were born prematurely, and 32.2% had low birth weight. The prevalence of stunting, underweight, wasting and thinness among the OA children were 64%, 49%, 14% and 12%, respectively.

In the Phase 2 study, data on household, maternal and child characteristics, dietary intake, caregiving behaviours, and common childhood illnesses were obtained from parents of children using a set of pre-tested interviewer-administered questionnaire and home observation checklist. Weight and length/height were also measured using standard procedures. There were 54.2% boys and 45.8% girls, in that 78% were from poor households. Approximately 31% of mothers had no formal education and 74% were housewives. About 14% of mothers had stature <145 cm, 8.9% were underweight and 28.5% were overweight/obese. A majority (76.6%) of children were born at health

facilities, with average length and weight at birth of 48.18 ± 2.63 cm and 2.66 ± 0.44 kg, respectively. The rates of preterm birth and small for gestational age were 15.4% and 71%, respectively.

Only 59.8% of children were breastfed within 1 hour of birth, 19.6% were exclusively breastfed for the first 6 months of life, and 44.4% started complementary food at 6 months of age. Most children (92–100%) did not achieve minimum acceptable diet during 6–60 months of age, in which only 0–55.6% of children achieved a minimum dietary diversity while the proportion of children achieving minimum meal frequency decreased with age (from 96.1% to 41.7%). At ages between 12 and 36 months, only 45–60% of children were responsibly fed by their mothers during lunch. The *Jah Hut* mothers were more affectionate and responsive (scores range: 9 to 10) to their children aged 6–24 months, but their interactions through encouragement and teaching (scores range: ≤ 7) were lacking during the first 5 years of age. The hygiene behaviour among the *Jah hut* community was generally satisfactory (scores range: 14.5 to 18.7), but safe garbage and faeces disposal, and hand washing with soap were not widely practiced. Most children (93%) received all immunizations based on the national immunization schedule. Between 6 and 30 months of age, a high proportion of children (35–41%) experienced certain common childhood illnesses in the past 2 weeks. About 20–29% of children did not seek treatment from health care provider or did not received any treatment when sick.

This study showed that the *Jah Hut* children experienced faltering in length-for-age (LAZ) and weight-for-age (WAZ) during the first 2 years of life. In a multivariate analysis, children living in households with greater number of children (AOR: 1.16; 95% CI: 1.02–1.38) and whose mothers with height < 145 cm (AOR: 7.53; 95% CI: 2.28–24.91) or 145–150 cm (AOR: 2.63; 95% CI: 1.34–5.14) and were delivered at home (AOR: 5.95; 95% CI: 2.26–15.69) were more likely to have an increased risk of stunting at the end of 2-year follow-up. The practice of responsive feeding during the 2–3 years of life (time 1) was protective against child stunting at ages 30–60 months of age (AOR: 0.63; 95% CI: 0.41–0.96). Children aged 6–36 months who were in the lowest tertile of hygiene behaviours (time 1) had 4.2 times greater risk of being stunted at ages 30–60. For mother-child interactions, the likelihood of being stunted at ages 30–60 months was 5.25–7.44 times higher among children aged 18–48 months (time 3) who were in the Tertile 1 and 2 than those in the Tertile 3. Moreover, children aged 24–54 months who experienced certain common childhood illness in the past 2 weeks (time 4) were 3.52 times more likely to be stunted at ages 30–60 months.

In conclusion, stunting remains as the most prevalent form of undernutrition among the under-five OA children (Phase 1), with a faltering in LAZ during the first 2 year of life was more pronounced than WAZ (Phase 2). Therefore, the first 2 years of life is a “window of opportunity” to promote optimal linear growth in OA children. Implementation of nutrition-specific and -sensitive interventions during this critical period could prevent early growth retardation and subsequently improve health and well-being of OA children. This study also underscores the important advantage of having early prevention (before or/and during pregnancy) and reinforcing family planning program to break the vicious intergeneration cycle of malnutrition.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

FAKTOR-FAKTOR YANG BERKAITAN DENGAN STATUS TUMBERSARAN KANAK-KANAK ORANG ASLI DI TEMERLOH, PAHANG, MALAYSIA

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Kekurangan zat makanan masih merupakan masalah utama kesihatan awam dalam kalangan kanak-kanak Orang Asli (OA) di Semenanjung Malaysia. Kebanyakan kajian tentang kekurangan zat makanan dalam kalangan kanak-kanak Orang Asli dan faktor-faktor yang berkaitan dengannya adalah menggunakan reka bentuk keratan rentas, tetapi bukti yang berkaitan tentang kajian membujur adalah terhad. Objektif utama kajian ini adalah menentukan faktor-faktor yang berkaitan dengan status tumbesaran kanak-kanak OA di Temerloh, Pahang, dan kajian ini terdiri daripada 2 fasa. Fasa pertama adalah kajian keratan rentas ($N=304$) dijalankan untuk menentukan prevalens kekurangan zat makanan dalam kalangan kanak-kanak berusia <5 tahun di 11 kampung OA terpilih di sekitar Rezab Hidupan Liar Krau, di daerah Temerloh Pahang. Hasil penemuan Fasa 1 ini digunakan untuk menyokong pelaksanaan fasa yang selanjutnya, iaitu satu kajian kohort prospektif yang dijalankan selama 2-tahun ($N=214$) untuk mengenal pasti corak tumbesaran kanak-kanak (berusia ≤ 3 tahun) dan faktor-faktor yang berkaitan dengannya dari tujuh kampung Jah Hut terpilih di daerah Temerloh Pahang.

Dalam kajian Fasa 1, maklumat tentang demografi dan sosio-ekonomi isi rumah dan ciri-ciri kanak-kanak telah diperoleh daripada ibu bapa kanak-kanak. Berat badan dan panjang/tinggi kanak-kanak juga telah diukur. Majoriti kanak-kanak dalam kajian ini adalah Jah Hut (86.4%) dan tinggal di isi rumah yang miskin (75.9%). Kira-kira 25% daripada kanak-kanak tersebut dilahirkan pramatang dan 32.2% mempunyai berat badan lahir yang rendah. Kadar prevalens terbantut, kurang berat badan, tersusut dan kurus dalam kalangan kanak-kanak OA ini masing-masing adalah 64%, 49%, 14% dan 12%.

Dalam kajian Fasa 2, data tentang isi rumah, ibu dan kanak-kanak, pengambilan makanan, kelakuan penjaga dan penyakit kanak-kanak yang lazim telah diperoleh daripada ibu bapa kanak-kanak dengan menggunakan satu set borang soal-selidik dan senarai semak pemerhatian yang telah dipra-uji. Berat badan dan panjang/tinggi juga telah diukur dengan menggunakan prosedur standard. Terdapat 54.2% kanak-kanak lelaki dan 45.8%

kanak-kanak perempuan, di mana 78% adalah dari isi rumah miskin, Kira-kira 31% daripada ibu-ibu tidak mempunyai pendidikan formal dan 74% adalah suri rumah. Sebanyak 14% daripada ibu-ibu mempunyai ketinggian <145 cm, 8.9% adalah kurang berat badan, dan 28.5% adalah berlebihan berat badan atau obes. Majoriti (76.6%) daripada kanak-kanak dilahirkan di kemudahan kesihatan, dengan purata panjang dan berat badan pada kelahiran masing-masing adalah 48.18 ± 2.63 cm dan 2.66 ± 0.44 kg. Kadar kelahiran bayi pramatang dan kecil untuk usia kandungan masing-masing adalah 15.4% dan 71%.

Hanya 59.8% kanak-kanak disusukan dengan susu ibu dalam masa 1 jam selepas kelahiran, 19.6% disusukan secara eksklusif selama 6 bulan pertama kehidupan mereka, 44.4% mula mengambil makanan pelengkap pada usia 6 bulan. Majoriti kanak-kanak (92–100%) tidak mengamalkan diet minimum yang boleh diterima semasa usia 6–60 bulan, di mana hanya 0–55.6% daripada kanak-kanak mencapai tahap minimum dalam kepelbagaian makanan manakala kadar kanak-kanak yang mencapai tahap minimum dalam kekerapan pengambilan makanan menurun dengan usia (dari 96.1% kepada 41.7%). Pada usia antara 12 dan 36 bulan, hanya 46–60% kanak-kanak diberi makan dengan bertanggungjawab oleh ibu-ibu mereka semasa makan tengahari. Ibu-ibu Jah Hut adalah lebih penyayang dan responsif (julat skor: 9–10) terhadap anak-anak mereka yang berusia 6–24 bulan, tetapi interaksi mereka melalui galakan dan pengajaran adalah tidak mencukupi semasa usia 5 tahun yang pertama (julat skor: ≤ 7). Penjagaan kebersihan dalam kalangan masyarakat Jah Hut pada umumnya adalah memuaskan (julat skor: 14.5–18.7), tetapi pembuangan sampah dan pelupusan najis yang sistematik serta tabiat mencuci tangan dengan sabun adalah kurang diamalkan. Kebanyakan kanak-kanak (93%) menerima semua suntikan vaksin berdasarkan jadual imunisasi kebangsaan. Antara usia 6 hingga 30 bulan, sebahagian besar (35–41%) kanak-kanak menghadapi penyakit kanak-kanak yang lazim dalam masa 2 minggu sebelumnya. Kira-kira 20–29% kanak-kanak tidak mendapat rawatan daripada pakar/pegawai perubatan atau tidak menerima sebarang rawatan semasa sakit.

Kajian ini menunjukkan bahawa kanak-kanak Jah Hut ini mengalami penurunan min z-skor bagi panjang-untuk-umur (LAZ) dan berat-untuk-umur (WAZ) pada usia 2 tahun pertama. Dalam analisis multivariat, kanak-kanak yang tinggal dalam isi rumah yang mempunyai jumlah kanak-kanak yang lebih ramai (AOR: 1.16; 95% CI: 1.02–1.38), dengan ketinggian ibu <145 cm (AOR: 7.53; 95% CI: 2.28–24.91) atau 145–150 cm (AOR: 2.63; 95% CI: 1.34–5.14), dan yang dilahirkan di rumah (AOR: 5.95; 95% CI: 2.26–15.69) adalah lebih cenderung mengalami tumbesaran terbantut pada akhir 2 tahun susulan. Amalan pemakanan yang responsif pada usia 2–3 tahun yang pertama (*time 1*) adalah faktor perlindungan terhadap kanak-kanak daripada pertumbuhan terbantut pada usia 30–60 bulan (AOR: 0.63; 95% CI: 0.41–0.96). Kanak-kanak yang berumur 6–36 bulan (*time 1*), yang mempunyai skor kebersihan yang terendah (*Tertile 1*) adalah 4.2 kali berisiko tinggi mengalami pertumbuhan terbantut pada usia 30–60 bulan. Bagi interaksi antara ibu dan anak, risiko pertumbuhan terbantut pada usia 30–60 bulan adalah 5.25–7.44 kali lebih tinggi dalam kalangan kanak-kanak berumur 18–48 bulan (*time 3*) yang berada di *Tertile 1* dan 2 berbanding dengan mereka yang pada *Tertile 3*. Selain itu, kanak-kanak berumur 24–54 bulan (*time 4*) yang menghadapi penyakit tertentu dalam tempoh 2 minggu yang lepas adalah 3.52 kali lebih cenderung mengalami tumbesaran terbantut pada usia 30–60 bulan.

Kesimpulannya, tumbesaran terbantut kekal merupakan bentuk kekurangan zat makanan yang paling lazim dalam kalangan kanak-kanak OA berusia <5 tahun (Fasa 1), di mana penurunan min z-skor bagi LAZ dalam 2 tahun pertama kehidupan adalah lebih ketara daripada WAZ (Fasa 2). Oleh ini, 2 tahun pertama kehidupan adalah “peluang yang terbaik” untuk mempromosikan pertumbuhan linear optimum dalam kalangan kanak-kanak OA. Pelaksanaan intervensi pemakanan yang khusus dan sensitif dalam tempoh kritikal ini dapat mencegah tumbesaran terbantut pada peringkat awal dan seterusnya meningkatkan kesihatan dan kesejahteraan kanak-kanak OA. Kajian ini juga menekankan kepentingan melakukan pencegahan awal (sebelum atau semasa kehamilan) dan memperkukuhkan program perancangan keluarga untuk menghentikan kitaran malnutrisi dari satu generasi ke generasi seterusnya.



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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follow:

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LIST OF ABBREVIATIONS

AGA	Appropriate for gestational age
AOR	Adjusted Odds Ratio
ARI	Acute respiratory infections
BAZ	Body mass index-for-age
BMI	Body mass index
CI	Confidence Interval
DDS	Dietary diversity score
DHS	Demographic and Health Survey
FATA	Federally Administered Tribal Areas
IYCF	Infant and young child feeding
JAKOA	Jabatan Kemajuan <i>Orang Asli</i> (Department of <i>Orang Asli</i> Development)
KWR	Krau Wildlife Reserve
Lao PDR	Lao People's Democratic Republic
LBW	Low birth weight
LGA	Large for gestational age
L/HAZ	Length/height-for-age
LMICs	Low- and middle-income countries
MAD	Minimum acceptable diet
MDD	Minimum dietary diversity
MMF	Minimum meal frequency
MICS	Multiple Indicator Cluster Surveys
NHMS	National Health and Morbidity Survey
OA	<i>Orang Asli</i>
OR	Odds Ratio

PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara (Department of Wildlife and National Parks)
PICCOLO	Parenting Interactions with Children: Checklist of Observations Linked to Outcomes
RCT	Randomized controlled trial
RF	Responsive feeding
RR	Relative risk
SD	Standard deviation
SGA	Small for gestational age
WASH	Water, sanitation and hygiene
WAZ	Weight-for-age
WHO	World Health Organization
WL/HZ	Weight-for-length/height

CHAPTER 1

INTRODUCTION

1.1. Background

Global under-five mortality rate has declined by 58%, from 93 deaths per 1,000 live births in 1990 to 39 deaths per 1,000 live births in 2017 (UNICEF, 2018). However, nearly half of the world's under-five deaths are attributable to undernutrition (UNICEF, 2019). Child undernutrition is still a public health concern. In 2017, about 22% of under-five children in the world were stunted (150.8 million) and 7.5% wasted (50.5 million) (UNICEF et al., 2018). Stunting and wasting affected nearly 58.7–83.6 million and 13.8–35.0 million under-five children, respectively in the regions of Asia and Africa (UNICEF et al., 2018). While the prevalence of child undernutrition remains high, there is an increasing prevalence of child overweight (<5 years) from 4.9% (30.1 million) in 2000 to 5.6% (38.3 million) in 2017 (UNICEF et al., 2018).

In Malaysia, the National Health and Morbidity Survey (NHMS) showed that the prevalence of stunting among under-five children decreased from 17.3% in 2006 (Khor et al., 2009) to 11.3% in 2011 (IPH, 2011) but increased to 20.7% in 2016 (IPH, 2016). Different trend has been observed in underweight with the prevalence increased from 12.9% in 2006 (Khor et al., 2009) to 19.6% in 2011 (IPH, 2011) but decreased to 12.4–13.7% in 2015–2016 (IPH, 2015 & 2016). The prevalence of under-five overweight increased from 5.3% in 2006 (Khor et al., 2009) to 7.6% in 2015 (IPH, 2015), and slightly decreased to 6.4% in 2016 (IPH, 2016). The NHMS 2016 reported that stunting (23.3% vs. 19.2%) and underweight (15.1% vs. 12.9%) in children aged <5 years were more prevalent in rural as compared to urban areas while the prevalence of child obesity (6.9% vs. 5.5%) was slightly higher in urban than rural areas (IPH, 2016). This simultaneous occurrence of under- (stunting) and over-nutrition (obesity) among the under-five could be due to nutrition transitions that influenced by rapid socio-economic development in Malaysia (Noor, 2002). The under-five children are experiencing changes in food consumption habits and lifestyle towards a nutritional energy densification and a reduced physical activity.

The first 2–3 years of a child's life is a window of opportunity for optimal growth and development (Ludeen et al., 2014; Rehman et al., 2009). Data from 54 low- and middle-income countries (LMICs) showed that the z-score of weight-for-age (WAZ) and height-for-age (HAZ) of newborns started close to the WHO growth standards but faltered thereafter until reaching a nadir of approximately -1 z-score and -2 z-score, respectively at 24 months (Victora et al., 2010). A prospective birth cohort of Indian children were reported to experience growth faltering throughout the first 3 years of life, with high proportion of children at the ages of 12–36 months were affected by stunting (39–61%) and underweight (26–43%) (Rehman et al., 2009). Analyses of five birth cohort studies conducted in Brazil, Guatemala, India, the Philippines and South Africa have also consistently shown a faltering in mean L/HAZ between birth (ranged from -0.6 to -0.1 SD) and 24 months of age (ranged from -2.9 to -0.6 SD), with an increased prevalence of stunting from 5.8–9.4% to 13.2–81.2% (Ludeen et al., 2014). These studies underscore

the importance of the first 2–3 years of life in promoting optimal growth and development in children.

Undernutrition in early childhood could adversely affect child survival, growth and development. Children who are under-nourished in early infancy have increased risk of morbidity and mortality from infections (i.e. respiratory tract infections and diarrhea), impaired cognitive development and reduced educational performance in childhood and adolescence (Adair et al., 2013; Olofin et al., 2013; Victora et al., 2008; Grantham-McGregor et al., 2007). The COHORTS studies (Consortium on Health Oriented Research in Transitional Societies) found that stunting in the first 2 years of life was associated with delayed school enrollment, higher risk of grade failure and early school drop-out, after controlling for sex, socio-economic status and maternal schooling (Martorell et al., 2010). Suboptimal cognitive and educational performance due to early childhood undernutrition is also associated with lower economic productivity and poverty in later life (Grantham-McGregor et al., 2007).

Undernutrition in early childhood is also associated with an increased risk of overweight and obesity later in life (Lobstein et al., 2015; Victora et al., 2008). Children who were stunted in the first 2 years of life and experienced rapid weight gain later in childhood and adolescence, were at a greater risk of being overweight or obese in adulthood (Victora et al., 2008). Such weight gain is also associated with unfavorable metabolic profile such as high blood glucose concentrations, blood pressure, and harmful lipid profile, which in turn increased the risk of coronary heart disease, stroke, hypertension and type 2 diabetes (Adair et al., 2013; Victora et al., 2008).

1.2. Problem statement

Globally, indigenous peoples make up about 5% (~370 million) of the global population with at least 5,000 distinct cultural-linguistic ethnic groups of indigenous peoples (IWGIA, 2008). Indigenous peoples are among the most vulnerable and marginalized population in the world. The World Bank (2011) estimated that there was one-third (~100 million) of poor indigenous peoples in the world, which were about 10% of the world's poor. The indigenous peoples of Peninsular Malaysia (*Orang Asli*, OA) contribute to about 0.6% of the national population (JAKOA, 2016). The OA has been recognized as one of the poorest groups in Malaysia, with reported rates of poverty and hard-core poverty at 31.2% and 20% respectively (National Census for *Orang Asli*, 2010). These rates are higher than Malaysia's national poverty rate of 0.4% in 2016 (EPU, 2018). The indigenous peoples are also experiencing food insecurity, especially those living in remote and isolated communities (Egeland et al., 2010).

Undernutrition is more prevalent in under-five indigenous children than non-indigenous children (Silburn et al., 2011). In India, the National Family Health Survey (NFHS-4) reported that nearly half of under-five indigenous children were stunted (44%) and underweight (45%) (MoHFW & IIPS, 2015-16). A higher prevalence of under-five stunting was reported among indigenous children in Latin American countries as compared to non-indigenous children, accounting to 25.3% in Mexico, 25.7% in Brazil, 42.1–56.2% in Peru, 42.3% in Ecuador and 72.1–80.7% in Guatemala (NISP & UNICEF

Mexico, 2016; Díaz et al., 2015; Anticona & San Sebastian, 2014; Freire et al., 2014; Horta et al., 2013; Chaparro, 2012). The prevalence of stunting, underweight and wasting among under-three indigenous children in western China were 20–27%, 7–16% and 3–9%, respectively (Qu et al., 2013). In the remote Northern Territory communities in Australia, about 15%, 6% and 5% of under-five indigenous children were underweight, stunted and wasted (NT Department of Health, 2015).

Similar to the world's indigenous peoples, undernutrition still prevails as a public health concern in OA children of Peninsular Malaysia. The prevalence of undernutrition among OA children was substantially higher than the prevalence reported in the national surveys (IPH, 2016; Poh et al., 2013). About 28.6–85.9% of OA children aged ≤ 6 years were reported to be underweight and stunted in various studies in Malaysia (Siti Fatimah et al., 2018; Chua et al., 2012; Saibul et al., 2009; Khor & Zalilah, 2008; Wan Norlida et al., 2007; Shashikala et al., 2005). A study in Gua Musang district of Kelantan reported that majority of OA children aged 1–6 years were underweight (45.3%) and stunted (76.2%) (Oui et al., 2016). However, the prevalence and distribution of stunting, underweight and wasting in OA children vary across geographical areas and sub-tribes in Malaysia.

Tracking the pattern and timing of growth faltering in infancy and early childhood is important to identify the “window of opportunity” for preventing undernutrition and subsequent growth faltering among indigenous children. Available studies revealed that there are differences in the patterns and timing of growth faltering in both weight and height among indigenous children across regions and countries. Cross-sectional data on indigenous children in Tibet and India showed that the prevalence of stunting among doubled from the ages of 6–11 months to 18–23 months (UNICEF, 2014; Kang et al., 2010). Findings from the first national survey of indigenous peoples in Brazil reported that the prevalence of child stunting increased from 0–5 to 24–36 months of age (Horta et al., 2013). Two longitudinal studies in the Western Highlands of Guatemala found that children experienced a marked faltering in mean L/HAZ from birth to 24 months of age (Nagata et al., 2016; Bergard et al., 2013). In a more recent birth cohort study in rural district of tropical coastal Ecuador, the mean L/HAZ of Mestizo/Native children declined from -0.4 SD at birth to -1.3 SD at 36 months, thereafter increased to above -0.9 at 60 months of age (Alvim Matos et al., 2017). Yet, there is no longitudinal study so far that investigates the pattern and timing of growth faltering among OA children in Malaysia.

Early childhood undernutrition is caused by an interaction of biological, societal, cultural and environmental factors. Longitudinal studies conducted in Bangladesh, Brazil and Ethiopia have identified several factors associated with increased risk of child stunting at age 12 – 24 months, including living in rural residence, poor household asset index, poor household sanitary conditions, shorter duration of exclusive breastfeeding, and presence of anemia over 12-month period (Islam et al., 2018; Queiroz et al., 2012; Medhin et al., 2010). In an urban slum of India, the risk of child stunting at age of 36 months was higher among those from “beedi-making” households, having at least one older sibling, and being under-nourished at 6 months of age (Rehman et al., 2009). A population-based follow-up study among the urban Amazonia children in Brazil found that wealth index, land ownership, maternal height, child birth weight and length were positively associated with linear growth throughout childhood (Lourenço et al., 2012). There were also growing evidences that maternal short stature and low birth weight were

significantly associated with increased risk of stunting throughout childhood, i.e. in the first 2 – 3 years of life (Islam et al. 2018; Utami et al., 2018; Addo et al., 2013; Christian et al., 2018; Rehman et al., 2009). The causes of early childhood undernutrition may vary from one population to another, and thus more research is needed to investigate specific factor contributing to early childhood undernutrition.

Understanding factors associated with growth faltering in indigenous children is essential as early childhood undernutrition can adversely and irreversibly affect developmental potential, health and human capital in later stage of life (Adair et al., 2013; Olofin et al., 2013; Victora et al., 2008). However, longitudinal studies that allow cause-effect interaction between the growth of indigenous children and its factors are very limited. Only few prospective cohort studies were conducted in particular countries of Latin-America (Alvim Matos et al., 2017; Nagata et al., 2016; Bergard et al., 2013). A prospective cohort study of Guatemalan children (mainly indigenous Mayan) in the Western Highlands showed that increased household size, number of children <5 years old, and the presence of diarrhea in the past week were significant predictors of child's height-for-age at 2 years (Nagata et al., 2016).

In Malaysia, most OA studies to date addressing early childhood undernutrition and its associated factors were based on cross-sectional data (Siti Fatimah et al., 2018; Oui et al., 2016; Chua et al., 2012). Therefore, a longitudinal study was carried out to look into the concept on early childhood undernutrition and its associated factors in OA population of Peninsular Malaysia. This study was carried out in two phases in the OA community in the Temerloh district of Pahang, Malaysia. The first phase was a cross-sectional study to assess the nutritional status of under-five OA children. The findings of the Phase 1 were used as a foundational pillar to support the implementation of subsequent phase. The second phase was a 2-year prospective cohort study, which was further designed to examine the growth of OA children aged ≤ 3 years and its associated factors. Therefore, this study aims to address the following research questions:

1. What is the prevalence of undernutrition in OA children? (Phase 1)
2. What are the pattern and timing of growth faltering in weight and height among OA children? (Phase 2)
3. What is the major form of growth faltering in OA children (Phase 2)?
4. What are the significant factors of growth faltering in OA children (Phase 2)?

1.3. Objectives of Study

1.3.1. General objective

To determine factors associated with growth status of OA children (≤ 3 years) in Temerloh, Pahang.

1.3.2. Specific objectives

This study consisted of two phases. The findings of the phase 1 study were used as a foundational pillar to support the implementation of subsequent phase (phase 2 study). The objectives of the two phases were:

Phase 1 Study

1. To determine the prevalence of undernutrition (stunting, underweight, wasting and thinness) of OA children aged <5 years.

Phase 2 Study

1. To identify pattern and timing of growth faltering of OA children.
2. To assess
 - a) household characteristics (household size, number of children, number of schooling child, household income),
 - b) maternal characteristics (age, education, employment and nutritional status),
 - c) child characteristics (sex, age, birth order, place of birth, birth length and weight, and gestational age),
 - d) dietary intake (breastfeeding and complementary feeding, intake of food groups, minimum meal frequency, dietary diversity and acceptable diet).
 - e) caregiving behaviours (responsive feeding, mother-child interactions, hygiene behaviour, immunization status and health seeking behaviour), and
 - f) health status (common childhood illnesses) of OA children.
3. To determine factors (household, maternal and child characteristic, dietary intake, caregiving behaviours, and common childhood illnesses) that differentiates between normal and stunted OA children at the end of 2-year follow-up.

1.4. Study Hypothesis

There are significant associations of household characteristics, maternal characteristics, child characteristics, caregiving behaviours, dietary intake and common childhood illness with child stunting.

1.5. Research Framework

The research framework of this study is presented in Figure 1.1. This study consisted of two phases. Phase 1 was a cross-sectional study, which aimed to determine the prevalence of undernutrition among OA children aged <5 years. The findings of Phase 1 study provided a descriptive overview on current nutritional status of children in OA communities, which were used to support for implementing the subsequent phase (Phase 2). These findings were also used to estimate the sample size for the Phase 2 study.

The findings of Phase 1 study showed that stunting was the most prevalent form of undernutrition among under-five OA in KWR. Therefore, a 2-year prospective cohort study was carried out to further confirm the findings of the Phase 1 study. This study

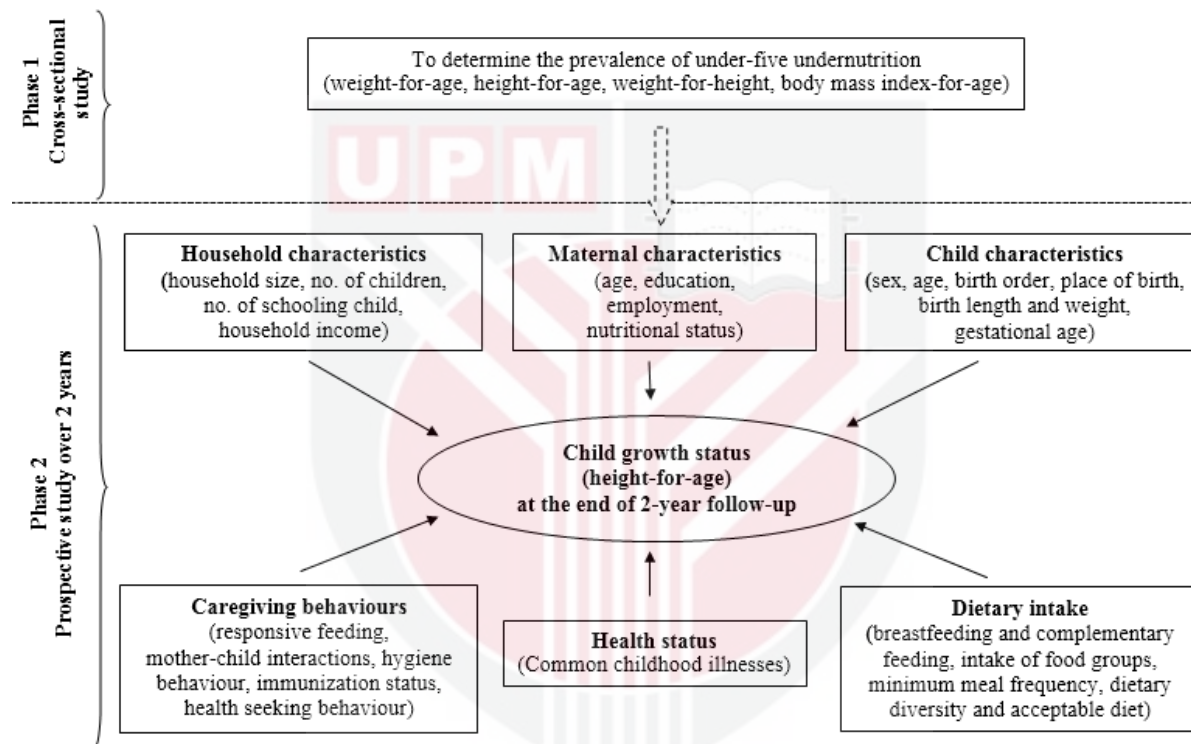


Figure 1.1: Research framework

aimed to track the growth status of OA children and to determine the factors associated with child stunting. Child stunting results from a complex interaction of biological, societal, cultural and environmental factors that are described in UNICEF Model of Care (Engle et al., 1996). The present study examined six main groups of independent factors, namely household, maternal and child characteristics, caregiving practices, dietary intake, health status of children.

Studies have shown that household factors such as household income, household size and number of children were associated with child stunting (Berngard et al., 2013; Nagata et al., 2016; Oui et al., 2016). Poverty has been identified as an underlying factor of childhood stunting. Children living in poor households were reported to have higher risk of stunting, as they tend to experience food and nutrition insecurity, and poor access to adequate health services, water and sanitation (Oui et al., 2016; Horta et al., 2013). Several studies also found that maternal characteristics such as educational level, employment status and nutritional status were associated with child stunting (Oui et al., 2016; Addo et al., 2013; Cobayashi et al., 2012). There are growing evidences that maternal short stature is an important risk factor of childhood stunting (Addo et al., 2013; Özalpin et al., 2010). Additionally, child characteristics such as sex, age, birth weight and length are important risk factors of stunting (Islam et al., 2018; Rachmi et al., 2016; Berngard et al., 2013). Low birth weight, preterm and small for gestational age infants had greater risk of being stunted in early childhood (Christian et al., 2013).

This study hypothesized that caregiving behaviours such as responsive feeding, mother-child interactions, hygiene behaviour and health seeking behaviour are associated with childhood stunting. A cross-sectional study in rural Ethiopia showed that children aged 6 – 24 months who were fed slowly by mothers had 0.28 times lower odds of stunting than those who were not practiced (Mugode et al., 2017). A prospective quasi-experimental study of a public health nursing intervention also found that intervention focused on supporting good nutrition and positive parenting significantly improved growth of stunted children in low-income Mexican-American families (Reifsnider et al., 2016). Moreover, a systematic review of DHS data from 70 LMICs has shown that access to improved water sources and sanitation (toilet facility) were associated with reduced risk of stunting (Fink et al., 2011). In addition, children who were immunized were found to be significantly associated with child linear growth (Berendsen et al., 2016; Atsbeha et al., 2015). Good nutrition and health are important for healthy growth in early childhood (Danaei et al., 2016; Jones et al., 2013; Lee et al., 2012; Marriott et al., 2012; Queiroz et al., 2012). It is hypothesized that poor health and inadequate of dietary intake (inappropriate of infant and young child feeding practices, and inadequate amount and variety of foods) are associated with poor growth in children.

1.6. Significance of study

At present, there are limited findings from longitudinal studies of the world's indigenous children as well as that of Malaysia's OA children. This 2-year prospective study could contribute to the gap of knowledge related to early childhood growth of OA in Malaysia. First, these findings could provide strong inference on the causal relationship between OA child growth and its associated factors. Second, the findings of this study could complement the existing information on nutrition and health of indigenous children.

Finally, these findings could support or reject previous study findings on the growth of indigenous children and its associated factors.

Monitoring the growth of indigenous children over 2-year period could provide useful information on the patterns and timing of growth faltering of indigenous children. Tracking the patterns and timing of growth faltering is a crucial step to identify “window of opportunity” for early prevention of childhood undernutrition. In addition, the insight on the patterns and timing of growth faltering of indigenous children could be the starting point for developing strategies to prevent early childhood growth retardation. Effective strategies that are initiated during the “window of opportunity” may ideally promote healthy growth of indigenous children.

An understanding of the key factors that influence early childhood growth retardation would be useful for prevention of early childhood undernutrition and subsequent growth faltering in indigenous children. This insight could guide and facilitate the Ministry of Health, Department of Orang Asli Development and non-governmental organizations in developing recommendations and therapeutic intervention strategies at a specific time point to improve the growth of OA children. For example, if inadequate dietary intake and poor health are key factors of growth retardation among the OA children during the first 2 years of life, interventions that focus on nutrition-specific and cultural sensitive strategies (e.g. promotion of appropriate infant and young children feeding practices, micronutrient supplementation or fortification, disease prevention and management) during this critical period of age could be effective to prevent early growth retardation or improve nutritional status in OA children. Additionally, the findings of this study could further strengthen the existing policies and strategies related to child nutrition and health (i.e. OA children) in Malaysia, in order to meet the Sustainable Development Goals (SDGs) of achieving internationally agreed targets on under-five stunting and wasting by 2025, and ending all forms of malnutrition by 2030.

This research protocol could serve as a guide or reference for use in future studies. The protocol could be improved and used for research on other sub-tribes of indigenous peoples in Peninsular of Malaysia. The expansion of works to other sub-tribes would provide good-quality data for a detailed comparative analysis across sub-tribes in understanding the growth of indigenous children in early childhood. In addition, this study may encourage other researchers to explore the long-term consequences of indigenous child growth as early child growth retardation is associated with adverse long term outcomes (Victora et al., 2008).

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BIODATA OF STUDENT

Wong Chee Yen was born in Tanjong Malim, Perak on 26th April 1984. She had education at SJK(C) Ho Pin, Slim Village. She obtained her secondary education at SMK Slim, Slim River, and continued her Form 6 education at SMK Aminuddin Baki, Kuala Lumpur. In 2007, she graduated with Bachelor Science (Nutrition and Community Health) at Universiti Putra Malaysia. She further persued her her Master study in Community Nutrition in following year and completed her study by 2011.

In year 2010-2011, she joined Versacomm Sdn Bhd, which is a health communication company that provide consultancy with specific expertise in the healthcare and wellness industries. She worked as a nutritionist cum communications executive. She had experiences in administration, coordination and implementation of programmes (e.g. Nutrition Month Malaysia). She also played a role in conceptualising and writing publication materials in relation to child nutrition and health.

She pursues her PhD degree under the supervision of Prof. Dr. Zalilah Mohd Shariff in year 2011/2012. Her current research interest is on child nutrition and health, i.e. Orang Asli children. She has published several papers while studying her PhD.

LIST OF PUBLICATIONS

Published articles

Wong CY, Zalilah MS, Siti Nur'Asyura A, Norhasmah S, Chin YS. (2018). Weight and height faltering in indigenous children (Orang Asli) of Peninsular Malaysia during the first 2 years of life. *Asia Pacific Journal of Clinical Nutrition* 27(4):886-892.

Wong CY, Zalilah MS, Chua EY, Norhasmah S, Chin YS, Siti Nur'Asyura A. (2015). Double-burden malnutrition among the indigenous peoples (Orang Asli) of Peninsular Malaysia. *BMC Public Health* 15:680

Poster presentation

Wong CY, Zalilah MS, Norhasmah S, Siti Nur'Asyura A, Chin YS. Overweight mother/stunted child pairs among Orang Asli households (double-burden households) in Krau Wildlife Reserve, Malaysia. 29th Scientific Conference – 3-4th June 2014, Renaissance Hotel, Kuala Lumpur



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