CHAPTER 5 :ANALYSIS AND DISCUSSIONS

5.1 Introduction

The systematic review and mixed-methods are identified as the most appropriate study design in answering the objectives of this study. The systematic review allowed evidence based data to be gather systematically following research questions (Uman, 2011). Whereas, mixed methods used to gain a better understanding of connections or contradictions between qualitative and quantitative data because it involves both quantitative and quantitative data gathering and analysis (Shorten & Smith, 2017). Therefore, there is a purposeful combination of quantitative and qualitative methods in data collection, data analysis, and interpretation of the evidence (Shorten & Smith, 2017).

In this thesis, the evidence gathered through a systematic review on behavioural and metabolic risk factors of NCDs among Orang Aslis was reported in Chapter 4 subheading 4.2. Sub-heading 4.3 and 4.4 provides an interpretation of the findings of the mixed-method study. Data from the systematic review used to answer the research questions and support the finding from quantitative study. The results of the quantitative and qualitative study discussed concurrently. It reflects how the data are interconnected and supported each other to answer questions about the research.

The quantitative phase used to determine the prevalent are major NCDs and its risk factors and also their health behaviour towards NCDs. While the qualitative discussion is intent around the quantitative finding, it gave an in-depth understanding

of the two phases to integrated following a mixed-methods design. Several sub-themes that emerged from the interviews seen to have a direct relationship with and influence on the quantitative results. The implications of the study findings and the strengths and limitations of this study then discussed.

5.2 Systematic Review Summary of Evidence

We identified 12 reports published between 1991 and 2018 for behavioural risks and 16 reports published between 2002 and 2019 for metabolic risks of NCDs. Overall, there was an increased interest in this area over time as there is an increase in numbers of publication over the years. However, the total number was still very low, and there were limited studies in recent year with no specific data on the Orang Asli in Malaysia (IPH, 2015b; Chan et al., 2017; Lim et al., 2018). The majority of the citations also did not report on the years of the research was conducted.

The Orang Asli community has been undergoing epidemiological and nutrition transition in recent years that impact on their health and development (Redzuan & Gill, 2008; Abdullah et al., 2016). The lack of information on the study period and the sampling populations compromised the quality of the research and the comparability between them. A direct inter-study comparison between each Orang Asli tribe or with other dominant ethnic groups in Malaysia is challenging due to the underlying heterogeneity, lifestyle differences, and operational definition used to measure the outcome of behavioural and metabolic risk of NCDs.

The logistic challenges were also highlighted by the researchers conducting studies among the Orang Asli. The main methodological limitation reported in most of the studies was the sample selection. Many researchers face logistic issues in terms of accessibility when conducting studies among Orang Asli communities. This is

particularly true for the Negrito tribe due to the remote location of their settlement (Geoffrey, 2013). The small sample size of Orang Asli respondents in several studies was attributed to the difficulties in accessing remote tribes and the small total population of the tribe, to begin with (Yusof et al., 2007; Rohin et al., 2018).

We highlight the need for more and standardised data measurement tool on the prevalence of behavioural and metabolic NCDS in Orang Asli communities. A more precise understanding of the prevalence of NCDs risks can help inform an estimate of the type and scope of health intervention and treatment services needed for each community.

5.2.1 Prevalence of Behavioural Risk Factors of NCDs

5.2.1.1 Smoking

The smoking prevalence in this review showed a higher prevalence of smoking behaviour in the Orang Asli communities, with a prevalence of more than 50.0% among the Jakun, Jahai, and Temiar tribe (Yusof et al., 2007; Wong et al., 2018). By comparison, the prevalence of current smokers in NHMS 2019 among general populations of was 21.3% (IPH, 2020). Whereas, from the 2015 NHMS report, the overall prevalence of smoking was 22.8% among Malaysians whereas the local prevalence in Negeri Sembilan was 20.9%. In comparison, the prevalence was higher among Other Bumiputera group with 25.8% than general Malaysian populations (IPH, 2015b). It is also worrying because one-third of those in the Other Bumiputera group, smoked more than 25 cigarettes per day, higher than general Malaysian population.

Tobacco use is a risk factor for many chronic diseases including COPD, CVDs including stroke and coronary heart disease, DM, and various cancers, in particular lung and oral cancer (Willi et al., 2007; Forouzanfar et al., 2016). In a systematic

review by Forouzanfar et al. (2016), tobacco is related to 7 million all-age deaths worldwide and attributed to 170 million DALYs for both sexes combined in 2015. In Malaysia, tobacco consumption is the second-highest risk factors ranked by the attributable burden of diseases. Additionally, the Malaysian Burden of Disease and Injury Study 2009-2014 revealed that one-fifth of DALYs and one-third of years of life lost (YLL) were due to smoking-related diseases (IPH, 2017).

Despite many health campaigns by the Malaysian government to reduce the smoking prevalence in Malaysia, the Orang Asli seemed to be neglected as there is a lack of educational and intervention programmes tailored for them (Hong et al., 2013). The previous study on smoking behaviours among secondary school students in Negeri Sembilan, reported percentages of adolescents Orang Aslis who are a current smoker is 17.1% (*n*=14/82), second after Malays (20.4%) and also higher than Indians (8.0%) and Chinese (5.9%) (Lee et al., 2005).

As smoking is becoming increasingly common in the general population and among the Orang Asli, particularly among the male gender, the prevalence data of smoking is vital to provide evidence for the preventive strategies. The scarcity of data in this area can seriously challenge the effectiveness of most anti-tobacco interventions. In short, more studies in this area are needed to curb this problem. The present study, therefore, attempts to bridge this knowledge gap by exploring the influencing factors of smoking behaviour among the Proto-Malay tribe.

5.2.1.2 Alcohol Use

From this review the prevalence ranged from 0% to 34.8% among the five Orang Asli sub-tribes higher than Malaysian general population but in line with indigenous peoples globally. Even though one study reported 0% alcohol

consumption in the Lanoh tribe (Cheng et al., 2014), the respondents involved in this study were only thirteen and might not have divulged their alcohol use accurately. Therefore, the results cannot be generalised to all the Orang Asli populations. By comparison, the reported prevalence of current drinkers among adults in the Malaysian population was only 8.4% (IPH, 2015b). And similar to indigenous peoples globally, based on systematic review by Weatherall et al. (2020) reported the prevalence of current alcohol used among indigenous people in Australia, New Zealand, Canada and the United States of America ranged at 3.8% to 33.3%.

Even though Malaysia is a Muslim country, alcoholic drinks are available for non-Muslims. In the Orang Asli population, alcohol consumption is considered as a social marker (Kortteinen, 2008), thus further complicating the efforts of the government to reduce NCDs. And among Orang Asli who are experiencing resettlement issues and gaining increased access to modernisation, there is an increase in alcohol consumption among them. A previous study showed that due to the sudden availability of money from the resettlement, they used the money to buy non-durable goods, particularly alcohol, instead of other essential products. Alcohol problems did not occur before the displacement of villages to the areas nearer to town (Swainson & McGregor, 2008). Alcohol use also is associated with problems including psychiatric morbidity and psychosocial problems among the Orang Asli (Abd Rashid et al., 2010), particularly among the male gender. In addition, another study conducted among women receiving antenatal care reported that one-third of women had wrong knowledge about alcohol consumption during pregnancy and one-fifth of them believed that alcohol will not affect the foetal growth (Rosliza & Muhamad, 2011).

Therefore, it is vital to study the prevention of risk factors such as alcohol use. By conducting a mixed-method study, apart from the data on the prevalence of

alcohol use, essential data on the knowledge of the behaviour, influencing factor, and barrier of the behaviour prevention can also be gathered. The results from this review emphasised the urgent need for awareness programme and further intervention to curb this problem.

5.2.1.3 Physical Inactivity

We identified five studies that reported the prevalence of physical inactivity among Orang Asli with all studies employed different methodologies or instruments in assessing the levels of physical activity among respondents. Furthermore, none of the studies used similar tools as the Malaysia NHMS (IPH, 2015a). The reported prevalence ranged from 15.8% to 50.0%. Due to the epidemiological transition in Indigenous peoples, they are slowly shifting towards a sedentary lifestyle (Wong et al., 2018). A systematic review of physical activity levels in adults Native American populations in Canada and the United States also reported lower activity levels since 2000, compared to 1990s and1980s (Foulds, Warburton & Bredin, 2013).

Increased automation, economical transition, lack of access to physical facilities, and the shift to physically less demanding modes of transportation are generally recognised as the by-product of modernisation of rural area and lifestyle transition (Atreya et al., 2018; Azzopardi et al., 2018; Fernández-Cao & Doepking, 2018). Apart from that, other factors that led to reduced physical activity among Orang Asli included poor maintenance of natural resources, lack of facilities for physical activities, and shift from labour-based to machine-operated agricultural activities (Saimon et al., 2015). Physical activity appears to have a long-term positive influence on health. Besides lowering the risk of developing NCDs, it also reduces the

costs for the health system (Reiner et al., 2013). The underlying determinant of this behaviour needs to be investigated.

5.2.1.4 Inadequate Fibre Intake and Unhealthy Diet

Sufficient intake of fruits and vegetables can reduce the risk of NCDs, coronary heart disease, ischaemic stroke, DM, and several cancers, including oesophageal, tracheal, bronchial, and lung, (Forouzanfar et al., 2016). Malaysian Dietary Guidelines recommended at least two serving per days for fruit and three serving per day for vegetables (NCCFN, 2010). From the review, the prevalence of inadequate fruits was higher with 64.3% to 96.0% compared to vegetables with 20.0% to 47.5%. Nevertheless, the different in exposure definition across studies making the comparable across studies challenging and none of the studies used the NCCFN (2010) guidelines.

In the NHMS report, the prevalence of Other Bumiputeras with adequate consumption of vegetables that followed the recommendations of the Malaysian Dietary Guidelines (NCCFN, 2010) was only 21.4%. The prevalence of adequate fruit intake was even lower at only 11.2% (IPH, 2015b). In a recent study by Chong, Appannah, and Sulaiman (2019), among the Orang Asli women from the Mah Meri ethnic group reported poor diet quality among Orang Asli with the mean serving intake for vegetables and fruits per day was 1.1 (*SD* = 0.8) and 0 (*IQR* = 0) respectively.

Low compliance with the Malaysian Dietary Guidelines will increase diet-related NCDs risks to the Orang Asli. The low number of studies that reported on this essential modifiable behavioural risk factor represents a vital research gap in this area. In addition, this systematic review shows the possibility of a high prevalence of

unhealthy diet among the Orang Asli populations. Nevertheless, previous studies are mostly quantitative research that might have only limited insights into certain matters. Thus, qualitative research is warranted to provide further insight into the barriers and challenges faced by the Orang Asli in meeting the Malaysian Dietary Guidelines recommended by the MOH (NCCFN, 2010).

5.2.2 Prevalence of Metabolic Risk factors of NCDs

5.2.2.1 Abdominal Obesity

In the review, the reported prevalence of abdominal obesity ranged from 0.8% to 37.0%, which is lower than Malaysia general population at 52.6% (IPH, 2020). Nearly half of the Malaysian population have abdominal obesity, the highest among all the countries in the South East Asia region (IPH, 2015b). Nevertheless, increased urbanisation in Malaysia has led to lifestyle changes with unwanted impacts on the major ethnicities and the minority group of Orang Asli in Malaysia. As reported by Phipps et al. (2015), even though the overall prevalence of abdominal obesity among the Orang Asli was 38.4%, the prevalence almost doubled among urbanised city-fringe Orang Asli (66.1%) and the sub-ethnic group of Seletar (66.1%) from the Proto-Malay tribe.

Being obese can lead to severe consequences for individuals and the country. Adverse metabolic effects of overweight and obesity can impact on the blood pressure, serum cholesterol, triglyceride, and insulin resistance, leading to increased risk of CVDs, DM, and various types of cancers such as breast, colon, and kidney (GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017; Tan et al., 2019). Additionally, apart from incurring higher healthcare costs due to decreased

work productivity, disability, and higher mortality, it also cast a direct burden on the healthcare system (Gill, 2006).

5.2.2.2 Raised Blood Pressure

In the current review, the weighted mean prevalence of raised blood pressure among the Orang Asli was higher compared to the prevalence of 30.3% among the general Malaysians but similar to the prevalence rate of 33.4% reported for the Other Bumiputera category in 2015 NHMS (IPH, 2015b). Since the Orang Asli tribe is not homogeneous, the data might not represent the real picture of raised in blood pressure prevalence among the Orang Asli in Peninsular Malaysia. A study by Phipps et al. (2015) showed different levels of hypertension among the Orang Asli of different tribes and localities, likely due to the socioeconomic impact and lifestyle changes.

High blood pressure is known as a silent killer disease that is often diagnosed by chance (Sawicka et al., 2011). Back in the 1970s, studies (Burns-Cox & Maclean, 1970; Burns-Cox, Chong & Gillman, 1972) showed a low mean BP value among Orang Asli respondents with an absence of coronary heart disease among Orang Asli. Elevated blood pressure increases the risk of CVDs and all-cause mortality as described in the literature (Forouzanfar et al., 2016; GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017). The WHO Global NCD Action Plan 2013-2020 targets to reduce the prevalence of increased blood pressure by 25% (WHO, 2013). Similarly, the national goal for Malaysia is to reduce the prevalence of raised blood pressure from 32.2% to 26.0% by 2025.

The results from this review showed a worrying trend of high blood pressure among Orang Asli. To reduce CVDs, the main contributor to mortality in Malaysia, the prevention, screening, and management of raised BP is vital (WHO, 2018). Thus,

this review warrants urgent attention to reduce the prevalence of hypertension via strategic prevention and management plan, via determining the prevalence among the targeted populations as well as understanding their behavioural practice.

5.2.2.3 Hyperglycaemia

Diabetes mellitus is a metabolic disorder characterised by the presence of chronic hyperglycaemia due to the resistance to insulin actions on peripheral tissues. It is also caused by inadequate secretion of insulin and impaired suppression of glucagon secretion in response to ingested glucose (Boada & Martinez-Moreno, 2013). This metabolic disorder is associated with the modern lifestyle risk factors of an unhealthy diet, low physical activity, increased body fat, heavy alcohol consumption, and smoking (Thévenod, 2008; Zheng, Ley & Hu, 2018). The complications of uncontrolled Diabetes mellitus include diabetic kidney diseases, diabetic retinopathy, and even amputation as a result of infections (Zheng, Ley & Hu, 2018).

The onset of hyperglycaemia frequently occurs years before the actual diagnosis. Nevertheless, many patients remain undiagnosed until the complications of the condition occur. In the review we found the prevalence of increased blood glucose ranged from 1.5% to 34.8%. The Orang Asli in the urban areas had a significantly higher prevalence of impaired fasting glucose and elevated glycated haemoglobin (HbA1c) as compared to those living in rural and deep forest areas (Phipps et al., 2015).

A study by Gill, Rosnon & Redzuan (2010) found that the availability of processed food near the villages propelled many of the Proto-Malays to spend their money on less nutritious foods such as instants noodles, junk food, and snacks. This is part of the negative exposure from modernisation that increases the vulnerability of

the Orang Asli communities towards Diabetes mellitus specifically and other chronic diseases generally.

5.2.2.4 Dyslipidaemia

The results of this review showed that the prevalence of dyslipidaemia was high with 6.9% to 23.9% for high triglyserides and 17.6 to 86.7% for low HDL-cholesterol. In a previous study by Burns-Cox, Chong & Gillman (1972), Orang Aslis were found to be physically thin and fit with only a slight risk of dyslipidemia and almost zero cardiovascular risks. However, with urbanisation, many Orang Aslis have undergone health transition. Abnormal lipid in the blood does not occur only in obese people. A person with a healthy BMI may also have hypertriglyceridaemia (Cercato et al., 2004). In studies comparing the prevalence of HDL cholesterol among rural Malay and Orang Asli (Ali et al., 2016; Ahmad et al., 2018), no significant difference was found between these two communities. Healthcare providers must be aware of this risks and perform the necessary monitoring and screening among these communities.

The number of studies conducted for the lipid profile was lower than the other components in the metabolic syndrome. The lipid profile requires biochemical parameters to be measured in the laboratory, thus becoming an additional protocol to the researchers. In comparison, other parameters such as abdominal obesity and high blood pressure only require physical measurement. The remoteness of the settlement location was also a main barrier for the researchers to obtain the lipid profile from the respondents.

Globally, dyslipidaemia is one of the major risk factors for CVDs (Nelson, 2013). It is also the major contributor to the mortality of both sexes in Malaysia

(WHO, 2018). Healthier lifestyles through modification of risk factors such as smoking cessation, high protein intake, reduced alcohol intake, and consistent physical activity have been shown to reduce the CVDs risks (Garg & Simha, 2007; Kopin & Lowenstein, 2017). Therefore, regardless of the Orang Asli localities, the sociodemographic change and urbanisation have increased the risks of developing NCDs among the Orang Asli of Peninsular Malaysia. A study in this area is vital to obtain a better understanding of the communities for them to embrace a healthy lifestyle as their ancestors.

5.2.2.5 Metabolic Syndrome

The weighted mean prevalence of metabolic syndrome in the Orang Asli (24.6%) was as high as reported in a study by Rampal et al. (2012) among the Malaysian population. There were discrepancies in the prevalence of metabolic syndrome among the major ethnic in Malaysia, whereby it was the highest among Indians (35.6%), followed by Indigenous Sarawakians (30.5%), Malays (26.4%) and Chinese (26.2%), respectively (Rampal et al., 2012). Whereas in another nationwide study by Mohamud et al. (2011), the reported prevalence for major ethnic in Malaysia was 47.3% for Indian, 38.8% for Malays and 32.9% among Chinese. Higher prevalence of metabolic syndrome in females Orang Asli also was comparable with studies in the general Malaysian population (Mohamud et al., 2011; Rampal et al., 2012). With a relatively high prevalence, it is evident that metabolic syndrome is a challenging public health issue to tackle among the Orang Asli as this condition lead to short and long term health effect.

5.3 Mixed Methods Sequential Explanatory Research

5.3.1 Response Rate

The overall response rate of 86.4% is very favourable compared with the highest recommended response rate of 60% in the literature (Johnson & Wislar, 2012). At this point, it is assumed that non-response bias is minimal, given the sample size is sufficient, and with a method of probability sampling used, all of which ensure a representative sample (Parashos, Morgan & Messer, 2005).

The number of samples included in this study was higher compared to the previous studies conducted among Temuan sub-tribe of Orang Asli on NCDs risks. A study by Adrian Jinam et al. (2008) recruited 110 Temuan Orang Asli from Negeri Sembilan state. Whereas, the research conducted by Mohamud & Suraiami (2010) recruited 119 Temuan Orang Asli from the state Selangor. Also, higher compared to a study by Chua et al. (2017) involving 132 Temuan Orang Asli from Pahang.

The high numbers of response rate achieved in this study are due to the high numbers of frequency visit to the villages. These frequent visits help to build rapport with the communities, thus increased their willingness to participate in this study. The research team also gave information about the survey to the head of the communities; therefore, the villagers were aware of the survey conducted.

5.3.2 Characteristics of Orang Asli in This Study

For a variety of reasons, many of the Proto-Malay Temuan Orang Asli moved from their old villages to settle at the new villages. According to respondents, these new villages were safer and provided more farming land and other facilities for them. In addition, some moved here after getting married to local villagers. Such transition

was also experienced by other Orang Aslis in Malaysia (Abdullah, Borhan & Ahmad, 2015; Abdullah et al., 2016; Crabtree et al., 2018).

The mean age of the respondents was 39.94 (*SD* = 13.92) years old. The finding is similar to the previous study conducted on NCDs risks among Orang Asli population (Ahmad et al., 2013a; Ali et al., 2016; Ahmad et al., 2018). The number of male respondents is lower while their mean age was higher as compared to females gender. Due to safety concern, data collection was conducted during the daytime of working hours. Hence, most of the younger working male were not available during the survey session. Several studies among Orang Asli also reported higher female respondents as compared to males (Yusof et al., 2007; Ahmad et al., 2018; Rohin et al., 2018).

Galobardes et al. (2006) identify the level of education as an indicator of an individual's socioeconomic position with low education and illiteracy disadvantage is related to poorer health. Only 28.9% (*n* = 94) of the respondents have attained the secondary and tertiary levels of education. From that, only 24.6% of them completed secondary school, less than half of the national average of 72.0% (Ministry of Education, 2013). From the observations and field notes during the interview session, the researchers found that the majority of the respondents involved in the study were illiterate.

In the current education system, the Orang Asli children attend the Malaysian public schools for their formal education. In contrast, the older generation did not have the same chance of education due to the limited access to public schools in previous decades. Therefore, many of the adults did not receive any formal education, as shown in many other studies among adult Orang Asli (Chandren, Wong &

AbuBakar, 2015; Wong et al., 2018). The experience was recounted by a respondent during the qualitative interview:

> *"Kalau dekat kampung lama dulu akak sekolah pun jalan kaki. Lampu suluh memang tak ada, pakai pelita. Kita keluar dari hutan pukul 5 pagi. Nak sampai ke sekolah pukul 6 lebih." (R, 39 years old)*
> *[When I was in the the old village, I used to walk to school. The flash-light does not exist, we use a fire lamp. We left the forest at 5 am. So we can get to school at 6 o'clock(R, 39 years old)]*

Household income is used as a measurement tool to identify the poverty category which related to socio-economic position of individual (Abdullah et al., 2019). Large numbers of Orang Asli in this study had low income. Their mean and median household income is RM 597.82 (*SD* = 448.01) and RM 500 (*IQR* = 300-800), respectively. The majority (68.2%) of them in hardcore poverty group. From field observations, most Orang Aslis work in the agricultural field. Among the produce farmed are rubber, oil palm and profit crops such as bananas and cassava. Thus, among working respondents, majority (94.1%) of them was self-employed with no stable income every month. From the qualitative interview, the respondent stated:

> *Sekarang kerja di kebun pisang. Di sini seperti itu lah, ambil daun pisang, tanam pisang. Ada juga yang menoreh." (RG, 50 years old)*

Level of education, literacy and income serves as serious impediments towards awareness on health. The represented population of lower socioeconomic status expected to possess a higher risk factor of exposing them to the development of chronic diseases (Chong, Appannah & Sulaiman, 2019; Peltzer et al., 2020). With low socioeconomic status, this increases the risk factor for the low quality of life and the poor health status of this indigenous people compared to other major ethnic (Anderson et al., 2016; Ithnin et al., 2020). In a most recent study by Wan Puteh et al. (2019) among Malaysian low income group found the low quality of life and poor

health status in this group.The respondents in this study highlighted the impact of low economic status in their lifestyle:

> *"Ada juga lah susah. Sayur, buah kena beli. Ada motor. Pucuk ubi ada lah di sini. Kalau ada duit beli lah. Kalau tak ada duit, tak beli. Makan sikit-sikit la. Pucuk ubi, ikan masin." (RD, 44 years old)*
> *[We need to buy vegetables and fruit to eat. Only tapioca shoots are available in this village. If there is no money, then we won't buy it. During the hard times, we only eat a little bit. Tapioca shoots and salted fish. (RD, 44 years old)]*

5.3.3 Major NCDs

Using the same operational definition in Malaysian population, the percentages of major NCDs of hypertension were 14.8%, followed by hypercholesterolemia at 5.2% and Diabetes mellitus at 4.3% is lower in this study compared to the prevalence in Malaysian general population as reported in recent NHMS, 2019 which is 15.9%, 13.5% and 9.4%, respectively (IPH, 2020). Stated by respondents in qualitative interview as below, the most common diseases among the adults Orang Asli were diabetes and hypertension:

> *"Biasanya orang kampung ni mengidap kencing manis, darah tinggi."(F, 35 years old)*
> *[The common diseases affecting the adult villagers are diabetes and high blood pressure. (F, 35 years old)]*

In a study by Wong et al. (2018), among the Proto-Malay tribe conducted at Tasik Chini, Pahang, they reported prevalence of major NCDs were using the same operational definitions as this study. However, they reported a much lower prevalence rate with known hypertension at 9.7%, known Diabetes mellitus at 4.2% and none with hypercholesterolemia compared to this study. The magnitude of NCDs burden faced by the Orang Asli in this study also shows a similar trend with a reported study among the rural Indigenous community living in Guatemala (Chen et al., 2017).

Among Indigenous Guatemalan community, the prevalence rate was 18.3%, 11.9% and 3.0%, for hypertension, hypercholesterolemia and Diabetes mellitus, respectively.

This study did not access the medicine adherence rate among those with chronic diseases. Nevertheless, finding from the respondents with major NCDs reported only 27.7% (*n*=18/65) go for regular follow-up at the healthcare facility. Reported study on medications adherence rate among the general Malaysian population with chronic diseases is unsatisfactory (Ramli, Ahmad & Paraidathathu, 2012; Ahmad et al., 2013b; Islahudin & Hasan, 2019). Whereas, the numbers of studies determining the level of medication adherence among the Orang Asli is very minimal. Study by Mattu et al. (2016) found lack of compliance to modern medical regimes among Indigenous peoples with chronic ill. With low knowledge on diseases, barriers in accessing healthcare facility, this area of study need further exploration, particularly among the Orang Asli communities as they may pose a different barrier than the general populations.

Following the conceptual framework of the study, several risk factors could lead to the development of NCDs. Using multivariate binary logistic regression analysis, we analysed the association between sociodemographic characteristic (age, gender, education background and hardcore poverty category), behavioural risk of NCDs (smoking status, alcohol behaviour, physical inactivity and insufficient vegetables intake), metabolic risks (abdominal obesity, raised blood pressure and increased blood glucose),and health behaviour (knowledge, attitude and practices score). with major NCDs.

The sociodemographic factor of older age had a significant association with self-reported hypertension as also shown in the previous study among the Malaysian population (Rampal et al., 2008; Abdul-Razak et al., 2016) and also the Orang Asli

(Wong et al., 2018). As the number of self-reported chronic diseases in the study was small, the 95% CI observed in this study was wide. A wide CI interval indicated that the effect was not well established and that further information is needed. Higgins & Green (2011) suggested that larger studies with bigger sample size can be conducted to produce narrower confidence intervals that can give a more precise estimate of effects, particularly in rare diseases that are of low prevalence.

For behavioural risks, the status of currently smoking showed a statistically significant inverse association with self-reported hypertension. Smoking and hypertension are the main risk factors of cardiovascular disease (Ezzati et al., 2005). However, there is still no consensus on the relationship between smoking and the incidence of hypertension. Some studies reported smoking as a risk factor for hypertension (Ezzati et al., 2002; Gao, Shi & Wang, 2017) while other studies found an inverse association between these factors (Li et al., 2017; Mehboudi et al., 2017; Kim et al., 2018). Studies among Malaysian (Rampal et al., 2008) showed no significant differences between smoking status and hypertension. Whereas, in study by Wong et al. (2018) among the Jakun Proto-Malay Orang Asli shows a significant inverse association similar with our study among Temuan Proto-Malay. They found those who smoke were 25.8% less likely to be in the hypertension category. The reasons behind the association and differences across studies need to be further investigated through more comprehensive, longitudinal studies that use standardised definitions for the Orang Asli so that the underlying mechanisms can be understood.

The factor of age group also show a significant association with self-reported hypercholesterolemia A similar conclusion was reached in previous study whereby the prevalence of hypercholesterolemia was higher among older Orang Asli (Ahmad et al., 2018). Previous studies on the lipid profile of Orang Asli revealed a high

percentage of them with hyperlipidaemia, including those living in the fringe or periphery areas (Tuan Abdul Aziz et al., 2016; Aghakhanian et al., 2018). Nevertheless, a high proportion of Orang Asli likely had undiagnosed hypercholesterolemia. Wong et al. (2018) found that from during interview, all 72 respondents in their study claimed not having hypercholesterolemia. Still, upon examination, 6.9% of the respondents had a high cholesterol level.

Respondents with self-reported hypercholesterolemia were associated with higher knowledge scores on NCDs. The importance of a balanced nutritional intake for the benefit of health was emphasised by a few respondents in the qualitative interview.

> *"Jaga pemakanan. Kurang minyak, makanan yang berlemak, kurang minum minuman manis, kurangkan makanan tinggi kolesterol. Ada jaga lah juga. Kalau kita tak jaga pemakanan kesannya pada kesihatan." (NK, 33 years old)*
> *[For us to maintain good health, we need to take care of our food. Watch out for our diet. Reduce oily and fatty foods. We also need to reduce high cholesterol foods and sweet beverages. I do practically all of that. If we do not take care of our diet, then it will affect our health. (NK, 33 years old)]*

Nevertheless, even though the level of knowledge scores on NCDs was high among the respondents with hypercholesterolemia, it might not necessarily be translated into their actual attitude and practice as many of them continued to have a low level of attitude and practice. Thus, even with good knowledge, the perceived impairment of healthy behaviour due to lifestyle changes and also negative experiences will contribute to health illiteracy (Peltzer et al., 2020).

In this study, regression analysis showed that the predictors of self-reported Diabetes mellitus included those who were older and had low physical activity. The increasing prevalence of DM could be attributed to lifestyle changes, increasing obesity, and population aging. Among the older population, the prevalence of diabetes

increased with age among Malaysian populations, including the Indigenous People, as reported by Rampal et al. (2010).

Physical activity plays an important role in Diabetes mellitus prevention (Reiner et al., 2013). Our study found a significant association between physical inactivity and self-reported DM. Those who are physically inactive are four times more likely to have Diabates Mellitus. The Proto-Malays who had transitioned from traditional to urban sedentary lifestyle after being resettled in the urbanised fringe areas showed a worsening trend of NCDs. This was supported by previous research that showed a higher percentage of metabolic risk factors of increased blood glucose among the Orang Asli in the urban and fringe areas (Phipps et al., 2015; Aghakhanian et al., 2018). Therefore, more study shall be conducted including the screening of the populations for diseases and intervention programs on increasing physical activity as the previous research had shown the additional benefits of physical activity in a lower incidence of diabetes in the general population (Smith et al., 2016).

Those who were having Diabetes mellitus had higher the odds of having increased blood glucose. This evidence on the risk factors for poor glycaemic control in people with Diabetes, also similar to Malaysian community-based study (Reidpath et al., 2018). This poses a challenge for the prevention of long-term complications of Diabetes particularly in the vulnerable and marginalised Orang Asli who had social and knowledge on diseases disadvantages (Ahmad et al., 2013a, Rosnon et al., 2019). Our study also found there is a significant increased in practices score among those with Diabetes mellitus. Previous systematic review study had shown the support of a positive effect of health education interventions on improved Diabetics' knowledge, attitude, and preventive practice, and health care outcomes (Wan, Rav-Marathe & Marathe, 2016). Thus, intervention planned for this community should aim at these

groups of high-risk subjects as the main target groups to also increased their knowledge and attitude towards diseases.

5.3.4 Behavioural Risk Factors of NCDs

WHO listed four health behavioural risk factors that are the leading causes of the highest-burden NCDs globally which are tobacco use, alcohol consumption, physical inactivity, and inadequate intake of vegetables. The four risk factors were assessed in this study (Figure 4.8) and compared with the national prevalence reported in NHMS 2015 and 2019 and the findings from the Phase One systematic review.

The comments by some Orang Asli in the qualitative study prompted a more in-depth exploration of the knowledge, influencing factors and barrier on NCDs behavioural risks among them. Despite commenting that they knew the four modifiable risk behaviours that cause deterioration to health, their knowledge was very general and not specific to any diseases. By understanding their obstacle in adapting this lifestyle behaviour will allow an intervention strategy that is suited to the needs of the Orang Asli without diminishing their social and cultural values (Rahman, 2018).

5.3.4.1 Smoking

The percentage of current smokers in this study was 28.0%. The figure was higher to the overall prevalence of the general Malaysian population at 22.5% (IPH, 2020), but similar to the previous report in Other Bumiputera categories with 25.5% (IPH, 2015b) from NHMS 2015 study. Previous studies with sample sizes between 34 and 482 Orang Asli respondents showed a wide range in the percentage of smokers, ranging from 27.8% to 56.9% (Ali, Shamsuddin & Khalid, 1991; Yusof et al., 2007; Ngui et al., 2011; Othman et al., 2012; Ahmad et al., 2018; Wong et al., 2018). Our

study had twice the participation rate than Ali, Shamsuddin & Khalid (1991) that was conducted among the Temuans in Hulu Langat, Selangor. The prevalence rate at 32.6% was similar to our study. This high prevalence of smoking is worrying because it is the major risk factor for NCDs such as chronic respiratory disease, Diabetes mellitus, cardiovascular disease including coronary heart disease and stroke, and also cancers (Forouzanfar et al., 2016).

With regard to smoking, many of the Orang Asli knew that smoking is unhealthy and can contribute to diseases. Nevertheless, despite the active campaigns by the Malaysian government to reduce the prevalence of smoking in Malaysia, Orang Asli seemed to be neglected with a lack of educational and intervention programmes seen targeting their specific populations (Hum, Hsien & Nantha, 2016). Only one respondent knew about the Quit Smoking Clinic listed in the National Quit Smoking Program by the Division of Disease Control, Ministry of Health Malaysia (2015) which offers assistance to smokers to discontinue tobacco use and ultimately quit smoking.

According to the review on smoking among adults by Hum, Hsien, & Nantha (2016), the predictors of tobacco smoking included male gender, alcohol use, adult age, lower-income, marital status, ethnicity, low education level, peer influence, urban residential area, poor parental knowledge, lifestyle behaviour, and health status. From the qualitative interview, factors associated with smoking behaviour among adult Orang Asli were social influence, personal desire, and nicotine addiction. Smoking behaviour was a typical practise particularly among Orang Aslis (Ahmad et al., 2018). Even though the majority of the Orang Asli who were interviewed knew the danger of smoking to health, they still found it difficult to advise their family members to quit

smoking. The barrier identifies in the in-depth interview were peer influence, addiction, and lack of motivation to quit smoking.

5.3.4.2 Alcohol Consumption

As for alcohol consumption, the prevalence of current drinkers at 7.1% was much lower compared with Malaysian general populations (11.3%) (IPH, 2020). Compared to the five studies among adult Orang Aslis in the systematic review with prevalences ranging from 0% to 34.8% in five studies among adults Orang Asli with sample sizes of 13 to 138 respondents (Ali, Shamsuddin & Khalid, 1991; Yusof et al., 2007; Ahmad et al., 2013a; Cheng et al., 2014; Wong et al., 2018), the prevalence in our study was in the middle range.

Even though most of the respondents knew about the negative effect of excessive alcohol consumption, several did not understand the adverse impact of this behaviour. For those who knew, they stated that alcohol could be detrimental to health because excessive intake could lead to intoxication and death. Furthermore, alcohol consumption had also caused social problems among the Orang Asli. Similar findings were reported in a previous study performed among Orang Asli at a resettlement villager in Selangor (Karim & Hashim, 2012). This study showed that increased alcohol intake by males added considerable stress and anxiety to the Orang Asli communities. Another study by Swainson & McGregor (2008) also claimed that the modernisation that resulted from the Orang Asli resettlement programmes has fuelled the alcohol problems among the Orang Asli.

The environmental difference in terms of increased urban-rural interaction had also increased the alcoholism behaviour among Orang Asli. From the interviews, the main driving factors for this behaviour were peer influence, stress, individual desire,

and extra money to spend. In the previous years, traditional alcoholic drinks were only consumed during festive celebration (Ali, Shamsuddin & Khalid, 1991). Due to the affordability and availability of alcoholic beverages near their settlements, some of the Orang Aslis were spending a lot of their money on the drinks (Swainson & McGregor, 2008; Gill, Rosnon & Redzuan, 2010).

5.3.4.3 Physically Inactive

One in every two persons (50.5%) in our study was physically inactive. This was in line with many literature that highlighted a worsening level of physical activity globally and regionally among the Indigenous People (Foulds, Warburton & Bredin, 2013; Mitchell & Shaw, 2015;Chen et al., 2017). As we used different operational definitions of physical activity, the level of physical inactivity was much higher in this study compared to among Malaysians (33.5%) and the Other Bumiputera (31.0%) category in 2015 NHMS (IPH, 2015b). However, a direct comparison cannot be made with the five previous studies among Orang Asli as all the studies used different methodologies or instruments in assessing the level of physical activity among respondents (Ali, Shamsuddin & Khalid, 1991; Poh et al., 2010; Othman et al., 2012; Pell et al., 2016; Wong et al., 2018). None of the studies used similar tools as NHMS 2015 (IPH, 2015b).

According to the Global Diseases Burden (2016), low physical activity can increase individual risks to various NCDs, including breast cancer, coronary heart disease, ischaemic stroke, and DM (Forouzanfar et al., 2016). There were also a number of respondents who did not know about the importance of physical activity on health. Their knowledge of this behaviour was also superficial in which they thought that a lack of physical activity could only cause obesity and weaken their body.

Bull & Bauman (2011) emphasised that physical activity is needed to reduce the risk of morbidity and premature death from NCDs. There has been a shift in the trend of physical activity among Orang Asli as the sedentary lifestyle gradually replaced their active lifestyle. Many of them stated that they had a limitation in conducting physical activities. The barrier identified in this qualitative study for doing physical activities was lack of physical activity facility, environmental influence and also time constraints. Research by Saimon et al. (2015) also concluded that similar barriers limited the uptake of physical activities among the Indigenous People.

It is vital to have a conducive environment that promotes physical activity to prevent a sedentary lifestyle. In this selected Orang Asli village, there was only one badminton court for the community use. For many of them, farming and gardening were considered as an exercise. Women in this study were more likely to face more barriers in exercising due to the lack of facilities such as footpaths and parks near their homes, and lack of time as they were busy managing their children and house.

Without a conducive environment that facilitate the behavioural modification, it is difficult to change the habits of physical (Sallis et al., 2006). In recent years, many alternative methods have been introduced to improve the uptake of physical activity. By adopting modern technology, it can be a motivational as it serves as a boasting factor and fulfils the intention to increase physical activity among Orang Asli (Walid et al., 2017). In a study among Indigenous Australian women, the use of digital health trackers enhanced physical activity and increased health knowledge among the study respondents (Maxwell et al., 2019). Therefore, exercise aids such as pedometers and mobile phone applications can be incorporated in the lifestyle behaviour modification programmes that are designed to help the Orang Asli in managing NCDs.

5.3.4.4 Inadequate Fibre Intake

About one in two (53.5%) of the study population of Temuan Proto-Malay did not fulfil the WHO recommendation of eating more than three servings of vegetables daily to minimise the risks of NCDs (WHO, 2013). Using the same operational definition in NHMS, this study showed a lower prevalence than the Malaysian population (88.8%) and among other Bumiputera (78.6%) (IPH, 2015b). Only three studies in this systematic review assessed the prevalence of inadequate vegetable intake. Nevertheless, all the operational definitions were different and not standardised across the studies. Therefore, the comparison of prevalence among studies cannot be made (Ali, Shamsuddin & Khalid, 1991; Ahmad et al,. 2013a; Wong et al., 2018).

Majority of respondents in qualitative interview agree that balance and nutritious eating behaviour is essential for health, with only one female respondent were unsure about the nutrition. The previous study among Orang Asli on diet and nutrition is very scanty. Only one study by Chong, Appannah & Sulaiman (2019) reported low nutrition knowledge among the women Orang Asli from Mah Meri sub-tribe within the district of Kuala Langat, Selangor. In another study conducted among Orang Asli in Jelebu shows worrying of consumerism trend. Due to the influence of telecommunication technology, the negative effects of advertisements from the mass media on unhealthy eating behaviour have a considerable impact on the lives of some of the Orang Asli. A study reported that the Orang Asli is spending a lot of their money on less nutritious foodstuff which is less nutritious especially instant noodles, junk food and snacks (Gill, Rosnon & Redzuan, 2010).

Lack of fibre intake from vegetables and fruits is also classified as poor dietary practice. It is closely linked to the development of chronic diseases

(Forouzanfar et al., 2016). It is assumed that the Orang Asli communities had less barrier in term of fibre intake. Nevertheless, the interview from this study found that, even though the majority of the Orang Asli in the villages relied on the agricultural activity as a source of income, the availability and choices of vegetables were limited for them. There is a limitation in daily consumption of traditional vegetables among the Temuan included shoots of fern, sweet potatoes, and tapioca and ulam such as *petai* and *jering* which were locally grown or gathered in the forest due to weather condition and also wild animal invasion to their farm. When these crop supplies was limited, they needed to get their vegetables from an outside source. However, this proved to be a challenge for some of them with financial constraints and transportation problems.

The Malaysian Dietary Guidelines recommended the consumption of at least two servings of fruits daily (NCCFN, 2010). This study did not quantify the intake of fruits. However, based on the qualitative interviews, the fruit consumption among the Orang Asli was very limited. Most of the available fruits in their villages, including *rambutan* and *durian*, were seasonal and thus limited their daily intake. The previous study by Haemamalar, Zalilah & Neng Azhanie (2010) also reported that the seasonal factor and too high fruit prices for both local and imported fruits at the markets is the contributing factors of low diet in fibres among the Orang Asli.

Further studies that focus specifically on the nutritional knowledge among the Orang Asli are essential because of the rapid nutritional transition and lifestyle transformation among the Orang Asli communities. Such research can provide important information to minimise the risk of nutrient deficiency that leads to malnutrition or excessive nutrition that increased the metabolic risks of NCDs.

5.3.5 Metabolic Risk Factors of NCDs

5.3.5.1 Obesity Indicators

In relation to obesity, it is a well-established fact that modernisation and improved economic prospects in the Orang Asli community are linked to increased obesity and metabolic syndrome (Grønning, Scambler & Tjora, 2012). It is recognised as one of the common intermediate risk factors for most of the weight-related NCDs, including CVDs and DM (Gill, 2006; Alberti et al., 2009). The obesity indicators measured in this study included BMI, abdominal obesity, and BFP. All the obesity indicators constitute in the NCDs risk as suggested by Zhu et al. (2004) and Ostchega et al. (2012).

Body mass index and waist circumference measure was the most practical, widely used, acceptable and accurate measurement of obesity in public health research (Booth et al., 2010; Appajigol, Somannavar & Araganji, 2020; IPH, 2020). A previous systematic review reported that BMI value had high specificity towards the diagnosis of obesity. However, it had low sensitivity in identifying adiposity, as it failed to identify one-half of the people with excess BFP in a previous study (Okorodudu et al., 2010). Whereas, abdominal obesity is one of the criteria for the diagnosis of metabolic syndrome. The used of BIA has been validated against reference techniques such as dual-energy X-ray absorptiometry (Thomson et al., 2007), and other body composition methods (Bosy-Westphal et al., 2003; Bhat et al., 2005) on its usefulness for body composition measurement. Thus, the BFP that is measured using BIA equipment have the extra advantages of being reliable, convenient, safe, portable, and easy to handle (Hu, 2008; Kim, 2016).

By using these measurements, more than half of the respondents (59.4%) were categorized as obese using BMI cut-off values. Another 59.7% had abdominal obesity and as high as four out of five (82.2%) of them were found to have high BFP. Compared to the findings in NHMS 2015, the prevalence of abdominal obesity among Orang Asli in this study was higher than the Malays in the general population (50.7%) (IPH, 2015b). However, the percentage of BMI obesity in this study was similar to another study among the Temuan semi-urban communities living in the fringe category (60.3%) (Adrian Jinam et al., 2008)

In our study, overweight and obesity have become a severe health issue among the Orang Asli in view of the high prevalence of obesity indicators among them. This is in line with high rates of overweight and obesity seen in indigenous populations word-wide (Mitchell & Shaw, 2015; Chen et al., 2017). It is now established that modernisation and a higher economic outlook in the Orang Asli corresponds to increasing obesity and metabolic measured (Masron, Masami & Ismail, 2013; Phipps et al., 2015). Besides causing nutritional transition, modernisation also leads to a more sedentary lifestyle. In contrast to previous times, the villagers now receive all the necessary amenities including clean water supply at their doorsteps. Ultimately, this reduces the house chores and eventually decreasing the level of physical activity that they perform. As stated in the qualitative interview:

> *"*Kalau dulu akak badan bukan macam ni. Kira macam kurus sikit la. *Kat sini memang senang sedikit la. Sebab air pun air paip. Kalau dekat kampung akak yang lama dulu nak ambil air kena buat gandar air. Susah." (R, 39 years old)*
> *[In the past, my body was not like this. More thinner. It is more convenient here. Even the tap water is also available. Last time it was difficult because we had to use a water axle.(R, 39 years old)]*

We determine the associated factors to metabolic risks of abdominal obesity using multivariate logistic regression analysis. From the analysis, females had almost

seven times higher odds of having abdominal obesity. The results are parallel with a review by Tan et al. (2019) that showed the prevalence of abdominal obesity to be more predominant among females. Similarly, Ashari et al. (2018) also reported a significantly higher number of female Orang Asli with obese BMI and increased waist circumference.

As for socioeconomic status, those in the hardcore poverty category were less likely to be in the abdominal obesity category. In developed countries, obesity is a condition that commonly affects people with lower socioeconomic status rather than those with higher socioeconomic status (Mitchell & Shaw, 2015). Nevertheless, in a review by Dinsa et al. (2012), the pattern of socioeconomic inequalities in obesity had a mixed picture in the middle-income countries. Our study result was similar with the previous study by Haemamalar et al. (2010) reported a significant association between increased household income and waist circumference in a community of Che Wong living in sub-urban area of Selangor. With the high prevalence of abdominal obesity and the available access to market-based food among the Orang Asli in this study, the risk of developing NCDs and the subsequent impact can be a big burden on the community.

This study found that there was an association between those who had raised in blood pressure are five times to be abdominal obesity. Previously, Chua et al. (2017) reported a significant association between raised in blood pressure and abdominal obesity in a community of Proto-Malay women living in Krau Wildlife Reserve, Pahang. And its also even worrying as 24.5% of respondents had raised in blood pressure during the examination were non-hypertensive respondents. As the risk of elevated blood pressure and abdominal obesity were coexist together, this needs public health attention to curb these problems. It is due to the growing burden of

cardiovascular diseases burden may be occurring in this vulnerable community as we found more than half of the study community is having abdominal obesity.

5.3.5.2 Raised Blood Pressure

Previous research shows higher percentages of metabolic risk factors among the Orang Asli in the urban and fringe category (Phipps et al., 2015; Aghakhanian et al., 2018). To assess the status of NCDs risks in our study, all respondents had their blood pressure measured. During the examination, 29.8% (n = 97/325) had a high blood pressure. The prevalence finding in this study is slightly lower compared to the weighted mean prevalence of high blood pressure at 32.2% in the previous study among the Orang Asli as reported in our systematic review. Nevertheless, the results must be compared with caution as the cut-off values for raised in blood pressure were different across studies (Ali et al., 2016; Ashari et al., 2016; Aghakhanian et al., 2018; Ahmad et al., 2018). The difference in the definition used across studies caused the finding of the study need to analysed pre-cautiously as it will influence the heterogeneous of the results.

Our study found the prevalence of under-diagnosed hypertension was 24.5%. Higher percentages of unknown hypertensive respondent with raised blood pressure in the vulnerable group of elderly, female gender, lower education and in hardcore poverty income category. Raised blood pressure progresses slowly over time and related to many causes, including unhealthy behaviour risks of NCDs that is preventable. Most of the time, this silent killer of hypertension has no apparent symptom. Therefore, many people do not realise that they are suffering from the disease. Costly disease management and prolonged treatment of NCDs and also life-threatening complications to vital organs such as heart, kidney and eye may increase

the burden of the disease to the minority populations of Orang Asli. In view of this, more studies need to be conducted. Adequate education and awareness programmes on early detection, screening and management of healthy behaviour are therefore crucial in assuring that they can sustain their health (Riley et al., 2016).

From the multivariate logistic regression analysis, the older age group, those with inadequate vegetable intake group, abdominally obese and had raised blood pressure had significantly higher risks of having increased in blood glucose (Table 4.25). Age was significantly related to raised in blood pressure as similar to findings in systematic review of population based measurement studies with 19.1 million participants by NCD Risk Factor Collaboration, 2017. The factors is coherent with chronic nature of NCDs, degenerative loss of protective hormones, dysregulation of homeostasis (Koopman & Kuipers, 2017).

The evidence on association between fibre intake and lowering the levels of blood pressure thus reducing the risks of hypertension was limited (Kassem, 2016). While some studies shown studies showed a significant relationship between fibre consumption and an increased risk of hypertension (Forouzanfar et al, 2016), some study shown an inverse association between fibre consumption and a reduced risk of hypertension (Uhernik, Erceg & Milanović, 2009; Huang et al., 2010) and a neutral relationship was found between fibre consumption and the risk of hypertension (Wang et al., 2012; Nyuyki et al., 2017). While the mechanism of blood pressure variation via fruit and vegetable consumption is not yet clear, a validated questionnaire's with more culturally adapted options can be added specifically to the Orang Asli population.

For metabolic risks, those with abdominal obesity and increased blood glucose were associated with having raised blood pressure category. This metabolic risks

condition was the cluster for metabolic syndrome that leads to chronic diseases of hypertension, Diabetes mellitus and CVDs. As previous studies among Orang Asli also showed an alarmingly high prevalence of raised blood pressure among Proto-Malay (Aghakhanian et al., 2018; Wong ey al., 2018); thus continuous population-based screening is essential for targeted prevention strategy conducted among the risky group.

5.3.5.3 Increased Blood Glucose

From the systematic review, only one study was conducted among the Temuan communities from Kuala Pilah and Jelebu, Negeri Sembilan on hyperglycemia by Adrian Jinam et al. (2008). Study using the same method of blood glucose measurement as this study reported lower prevalence of hyperglycemia with 2.6% compared to finding from our study with 5.5%. This finding is worrying as its might picture the effect of urbanisation to the Temuan Orang asli living in Negeri Sembilan.

In this study, among the 5.5% of respondents with abnormal blood glucose levels, 4.2% (*n*=13/311) was never diagnosed with Diabtes Mellitus. Higher percentages of unknown diabetic respondent with increased blood glucose in the vulnerable group of elderly, female gender, lower education and in hardcore poverty income category. Even though the prevalence was lower compared to undiagnosed Diabetes mellitus among the Malaysian populations at 9.2% (IPH, 2015b), it remains a worrying situation as inadequate knowledge of diseases among the Orang Asli among the vulnerable group can lead to complications of the disease (Ahmad et al., 2013a; Zheng, Ley & Hu, 2018).

Additionally, even though the number of diagnosed Diabetes mellitus were higher in the older populations, no significant different found in blood glucose level

across the younger and elderly age group. Previous studies among Orang Asli reported the high number of subjects of the younger age group in their studies having impaired fasting glucose (Mohamud and Suraiami, 2010; Wong et al., 2018). Therefore, the younger group also shall be included in any intervention strategy for diseases risks and health behaviour.

5.3.6 Knowledge on NCDs

Even though few studies (Ospina et al., 2015; Prince et al., 2018) reported the higher burden of NCDs among the Indigenous compared to the non-Indigenous people, there is generally lack of studies on the KAP of NCDs among the Indigenous people worldwide and regionally. Self-reported lack of knowledge on DM was reported in a study by Shaw et al. (2013) among Alaska Native adults. Whereas in another study by Van Hooser et al. (2020) found a low knowledge of heart attack and stroke among adults Native American compared to other ethnic of Caucasian, African American and Hispanic. This finding of low knowledge also parallels with a study by Ahmad et al. (2013a) on Diabetes among the Orang Asli, the Indigenous Peoples in Peninsular Malaysia.

The Orang Asli living in Jelebu have already been exposed and conditioned by the culture and practice of others local communities for some time. As the Orang Asli is undergoing urbanisation, their risks of developing lifestyle-related diseases are alarming (Othman et al., 2012). Therefore, their knowledge of NCDs is assumed to be improving as they become more accustomed to the local communities and also receive more exposure to various mass media including satellite television, radio, and network (mobile phone) coverage (Josephine, 2016; Rosnon et al., 2019).

However, the results from this study showed that only a small number of respondents had good knowledge about NCDs, which concur with the previous research conducted among the Indigenous peoples. About one in two of the Orang Asli respondents had never heard about NCDs. Only as few as 10.8% of them were able to differentiate the type of diseases correctly. On top of that, even though the Orang Aslis have been associated with a disproportionately high level of infectious and vector-borne diseases in previous studies (Chandren, Wong & AbuBakar, 2015; Wong et al., 2016; Loong et al., 2018), the majority of them did not know that dengue, tuberculosis, and leptospirosis were infectious diseases.

We compared the results of our study with an earlier survey that used the same instruments among the neighbouring Malays living in rural areas of Jelebu and Kuala Pilah, Negeri Sembilan. Only 36.6% of the respondents were able to answer all the behavioural risks of developing a heart attack compared to 77.8% among Malays (Ithnin et al., 2020) correctly. Even less Orang Asli respondents could give all correct answer about the behavioural risk factors of stroke with 35.1% compared to the Malay population in Negeri Sembilan with 75.3% (Ithnin et al., 2020).

Hypertension or high BP is a common illness among the Orang Asli. This was well acknowledged by many respondents in the qualitative study. However, in our study, only 28.0% of the Orang Asli could answer correctly on the statement about hypertension. Fortunately, slightly more than half of them would go for regular follow-up (54.2%) and adhere to the prescribed medicine (56.6%) if they were diagnosed with hypertension. Previous study found that 44.2% of female Orang Asli had low knowledge about complications that might arise with hypertension during pregnancy (Rosliza & Muhamad, 2011).

Compared to the other major NCDs asked in the knowledge section, the number of respondents that managed to provide all correct answers was lowest for DM (16.9%). This was consistent with findings in a cross-sectional study among the Orang Asli in which the majority of respondents were not able to identify the correct answers to diabetes-related questions. The study was conducted among the semi-urbanised Proto-Malays communities with access to city life, mass media, and modern amenities (Ahmad et al., 2013a).

As for chronic respiratory disease, the list of COPD symptoms was asked in the COPD Assessment Test (Jones, 2017). Compared to other diseases, COPD had the highest correct answers (40.6%) in the knowledge section regarding NCDs. However, less than half of the respondents had the right answer for all the symptoms. As COPD may resemble other respiratory diseases, further studies on the knowledge of the disease are essential, especially among the Orang Asli because many of them smoke and are thus exposed to nicotine, a common risk factor of COPD. Furthermore, many chronic respiratory diseases are under-diagnosed and under-treated (WHO, 2010; Ngui et al., 2011; Yap et al., 2012).

Our study demonstrated an association between the knowledge of respondents on NCDs and their education status. As mentioned earlier, during the interviews, the older generation of the Orang Asli was having difficulties in attaining any formal education. Orang Aslis with lower education level was two times higher more likely to have poor knowledge. A study by Van Hooser et al. (2020) found the less educated Indigenous peoples two times higher odds of having low knowledge towards heart attack and stroke. Similarly, a previous study also showed that a better educational background was linked with a higher knowledge level on minor illness among Orang Asli in the sub-urban areas of Malaysia (Tan, 2013). Several studies that assessed the

knowledge of chronic diseases among Malaysians also reported that the level of knowledge was related to the formal education background (Rosmini Remali, Zakaria & Yusof, 2017; Elnaem, Jamshed & Elkalmi, 2019).

Apart from education level, this study also found that respondents in the hardcore poverty group were two times more likely to be in the poor knowledge category. Similarly, poorer Indigenous people were found to be two times higher odds of having low knowledge of heart attack and stroke. This finding was also parallel with the study among Orang Aslis on the association of low income with low knowledge about dengue fever (Chandren, Wong & AbuBakar, 2015) and of soil-transmitted helminth infections (Nasr et al., 2013).

As for the multivariate analysis of NCDs behavioural risks, individuals with insufficient physical activity were significantly more likely to have poor knowledge. Physical activity is the main risk factor in the development of chronic diseases (Reiner et al., 2013; Smith et al., 2016). As stated in the qualitative interview, some of the respondents were unsure about the importance of adequate physical activity in disease prevention. Profound knowledge of the diseases could influence the attitude and practice towards the prevention of NCDs (Buang, Rahman & Haque, 2019). To the best of our knowledge, none of the Malaysian studies reported on the relationship between the intensity of physical activity and the KAP level on NCDs. Nevertheless, studies elsewhere among adolescents show that the knowledge about physical activity led to a positive attitude and subsequent behavioural modification in disease prevention (Ghaffari et al., 2012; Xu et al., 2017).

We found those with inadequate vegetables had poorer knowledge towards NCDs. This is concur with study by Chong, Appannah & Sulaiman (2019) which reported nutrition knowledge were positively correlated with diet quality among Mah

Meri Orang Asli living in Selangor. Thus, group at risk can be targeted for community knowledge and awareness programs.

5.3.7 Attitude towards NCDs

Attitude is described as a respondent's degree of favour or disfavour on opinions and general feelings about an issue, object, or person that are interlinked with the person's knowledge, beliefs, emotions, and values in which they can be either positive or negative (Eagly & Chaiken, 2007). The overall results from this study illustrated that less than half of the respondents (48.9%, n = 159/325) possessed a positive attitude towards NCDs. Nevertheless, the high cumulative attitude score was on the high side with a mean value of 59.81 (SD = 6.24) from a maximum score of 75.

In terms of attitude towards NCDs behavioural risk factors, the majority of the respondents showed a positive attitude towards the importance of a balanced diet, physical activity, restriction on daily fat intake, continuous healthcare, and also the effect of smoking on health. This was supported by the in-depth interviews in which many respondents expressed their feeling on the importance of a healthy lifestyle. Many of them also advised their children about the danger of smoking and alcohol. Still, a previous study on smoking behaviours among secondary school students in Negeri Sembilan reported a rather high percentage of adolescent Orang Asli who were smoking (17.1%). The percentage was lower than the Malay adolescents (20.4%) but higher than Indians (8.0%) and Chinese (5.9%) (Lee et al., 2005).

Regarding attitude towards food intake, only 38.2% of respondents agreed that they must consume food following the calories of their daily energy requirement. Almost half of them (46.5%) chose unsure answers. According to the Malaysian

Recommended Nutrient Intakes (RNI), the dietary energy sources are mainly from the intake of macro-nutrients (MOH, 2017c). Hence, a high proportion of carbohydrate, fat, and protein intake in daily energy intake may contribute to the development of obesity and chronic diseases. Further studies that focus specifically on the nutritional knowledge among the Orang Asli are essential because of the rapid nutritional transition and lifestyle transformation among the Orang Asli communities. Such research can provide important information to minimise the risk of nutrient deficiency that leads to malnutrition or excessive nutrition that increased the metabolic risks and NCDs (Rohin et al., 2018).

When asked about disease management, an overwhelming number of them showed a positive attitude towards as many of them agreed to control their diseases by undergoing diet modification to reduce sugar and salt intake besides going for regular check-ups at the healthcare facilities. They would also bring along their medication if they needed to travel. Chronic diseases, including hypertension, hypercholesterolemia and diabetes, is also known as a silent killer (Popescu et al., 2011). Therefore, attention shall be given on diseases management as it can lead to diseases complications of CVDs including stroke and heart attack, diabetic nephropathy and retinopathy and even mortality at a young age (Forouzanfar et al., 2016).

In this study, there were high numbers of negative and unsure attitude in taking the medication or injection to control diabetes complications. In a previous study by Ahmad et al. (2013a) regarding the choice of treatment for diabetes, most of them claimed that they would choose modern medicine. However, approximately one in three of them still preferred self-treatment (30.0%) and traditional healers (5.5%) for diabetes treatment. This corresponded with the findings from the qualitative interviews:

"Orang kampung ni, macam ubat tahan sakit, demam biasa ambil ubat doktor. Kalau kencing manis, darah tinggi Selalunya diorang makan ubat sendiri. ubat kampung". (F, 35 years old)

Even though the Orang Asli community has been undergoing modernisation, some of their social and traditional values were still intact (Karim & Hashim, 2012). Reciprocity and social obligation among Orang Asli such as taking care of the young, the old, or the sick as well as ensuring all tribe members had sufficient access to food and medicines are still a common practice (Wong, Allotey & Reidpath, 2016). Thus, it was not surprising that almost all of the respondents showcased a positive attitude towards helping family members with NCDs.

Poverty and backwardness remain a big challenge among many Orang Asli communities. Previous studies reported that among female Orang Aslis, their level of education, income, and distance from the hospital were associated with their level of knowledge and health behaviour towards breast cancer screening (Norlaili et al., 2013; Farid et al., 2014). Several studies also showed a significant association between obesity and breast cancer incidence (Pierobon & Frankenfeld, 2013; Argolo, Hudis, & Iyengar, 2018). Our study highlighted that a high percentage of women with obesity were from lower education and low-income background. Therefore, further exploration is essential as these Orang Asli would be most at risk of developing NCDs.

Similar to other risk behaviours, studies among Orang Aslis on the relationship of attitude towards chronic disease prevention are scarce. Our study found alcohol drinkers were significantly associated with a low attitude level. This concur with finding from Polen et al. (2010) which reported a worse health-related attitude among individuals who drink. From multivariate analysis, we also found physically inactive group and inadequate vegetable intake had poorer attitude towards NCDs. Concur with another study, lack of behavioural risks attitude link to increased

risks of developing NCDs (Habib et al., 2020). Also, similar to another study, individual with metabolic risks had a neutral attitude towards health behaviour and cardiovascular disease risk factors (Verma et al., 2019).

This poor attitude among those with preventable and modifiable behaviour risks of NCDs group may contribute to the upsurging burden of clustering of metabolic risks and also NCDs. Thus, studies targeting behaviours from a health behaviour had promising results with potential impact on NCDs health policies since positive attitude correlates with positive practices as reported in this study.

5.3.8 Practices on NCDs Behavioural Risks

Lifestyle-related chronic diseases such as obesity, DM, CVDs, and COPD are preventable and modifiable if individuals adopt a healthy lifestyle. By studying the individual- and community-level risks factor and practice through surveillance, targeted interventions can be conducted to modify the behaviour, therefore reducing the risk and disease burden in the future (WHO & Stop TB Partnership, 2018). This study looked into the Orang Asli practice on NCDs behavioural risks based on the healthy lifestyle behaviour recommended by the Malaysian Dietary Guidelines (NCCFN, 2010) and *Pelan Strategik Kawalan Tembakau* 2015-2020 (Division of Disease Control, 2015).

Only one in five of the Orang Aslis belonged to the good practice category with a mean practice score of 6.16 (*SD* = 1.527). Compared with the study by Ithnin et al., (2020) that used a similar survey instrument, the percentage of Orang Asli with good practice was similar to the Malays in the rural (18.3%), but higher than the Malays in the urban (8.7%) areas of Negeri Sembilan.

Our findings were also in line with the previous study on lifestyle behaviour among the Orang Asli by Ahmad et al. (2013a). This study showed 89.9% of the respondents were non-alcoholics and 52.5% of them had adequate vegetable intake. However, in this study, very few respondents measured their body weight regularly. The Malaysian Dietary Guidelines (NCCFN, 2010) highly recommended the checking of body weight at least once a week to maintain a healthy range of body weight. None of the previous studies among Orang Asli reported on their body weighing practice. However, since the overall results showed that most of the respondents were overweight or obese, it is necessary to look deeper into this issue. Intervention studies can be considered to identify the best strategies to reduce metabolic risks contribute to major NCDs (Dombrowski et al., 2014; Teixeira et al., 2015).

5.3.9 Correlation between KAP Regarding NCDs

There was a significant positive relationship between knowledge, attitude, and practice scores. Based on the correlation analysis between knowledge and attitude regarding lifestyle-related NCDs among the respondents, it was found that higher knowledge of diseases contributed to a better attitude and healthy behavioural practice. Moreover, there was also a significant positive correlation between attitude and practice. This result implied that someone who knew more about the disease had a better perspective and practice towards disease prevention. This finding was consistent with studies that found a significant correlation between knowledge, attitude, and practice regarding soil-transmitted helminth infections (Nasr et al., 2013) and malaria (Al-Adhroey et al., 2010) among Orang Asli.

Knowledge can be acquired through a continuous learning process and the experience gained over time. In a review by Wan, Rav-Marathe & Marathe (2016),

health education intervention was found to exert a positive effect that improved the knowledge, attitude, and preventive practice as well as healthcare outcomes of individuals. Therefore, similar studies are warranted among the Orang Asli population. The surveillance of risk behaviours is able to provide more understanding of the risks of the diseases to facilitate education on NCDs awareness in the high-risk group.

5.3.10 Health Seeking Behaviour and Treatment of Choices

The Orang Asli communities were receptive towards modern treatment as almost all of the respondents interviewed had used modern medicine to solve health-related problems. The results were in line with another study by Rosnon et al. (2019) among the Orang Asli community living in Jelebu which reported 92.6% of the respondents used government clinic or hospital for medical treatment. However, this was in contrast with the study among Orang Asli living in deep forest and inland. The Semai from Senoi group (Saub & Jaafar, 2001) and the Batek from Negrito group (Abdullah et al., 2014) still largely practised traditional lifestyles and medicine, especially in the aspect of ailment healing.

The Temuan is a sub-tribe of the Proto-Malay Orang Asli. They mostly live in the central states of Peninsular Malaysia. Their settlement can be in either urban areas, for example, the Temuans of Bukit Lanjan, Selangor, or in suburban areas, like the Temuans of Jelebu, Negeri Sembilan (JAKOA, 2010). The impact of urbanisation could be seen among the Temuan group in the shift of their treatment preference from traditional to modern treatments.

The use of traditional methods such as traditional medicines and traditional practitioners was practised by almost half of the respondents interviewed. For the Indigenous people, it is a standard practice to mix traditional and modern treatment

(Othman et al., 2012; Mattu, 2016). Traditional medicinal knowledge is commonly passed down the generations by the elderly. Even though some of the respondents knew traditional practice, those who were still actively practising it were dwindling in number. As mentioned by respondents in the qualitative interview, the lessened in traditional medicine practices were due to the decreased number of older generations, lack of interest by the younger generations, dwindling numbers of natural resources, and lack of traditional knowledge practice. Therefore, an increasing number of Orang Asli preferred the use of modern treatment, particularly in treating common fever or illness.

5.3.11 Accessibility and Barriers to Public Healthcare Facility, Services and Medicine

The Orang Asli community can no longer be viewed as an isolated community, especially with the government's efforts to integrate the Orang Asli into the modern society via the development of economy, education, and health (Masron, Masami & Ismail, 2013). The Orang Asli communities now have more access to the medical treatment and services provided by the government (Bedford, 2009). For example, this study was conducted at the Orang Asli settlements in the suburban areas near the forest fringes. The Orang Asli community in this area had relatively good access to basics amenities such as piped water, electricity supply, and connecting roads to other surrounding areas.

Therefore, it was not surprising that the majority of the respondents reported good accessibility to modern treatment. This echoed the sentiment of a previous study that highlighted government facilities as the preferred choice for treatment for Orang Asli (IPH, 2015c; Rosnon et al., 2019). The use of qualitative interviews allowed a

more in-depth exploration of this matter. According to the respondents, the quality of services provided by the government was excellent. It was also very convenient as it was near their housing area. Furthermore, medicine was readily available and effective in treating their illnesses. Besides, the government provided a regular mobile clinic with doctors and nurses to their villages as also experienced by the researcher during the study period.

In spite of that, there are still some obstacles faced by the Orang Asli in getting modern treatment. The findings from our study and a previous study (Rosnon et al., 2019) both highlighted the transportation issues among Orang Asli. Most of them owned a motorcycle. Car ownership was low among the Orang Asli due to financial limitations. Therefore, the most frequent transportation utilised by them to the neighbouring healthcare service centre was motorcycle (Rosliza & Muhamad, 2011; Tan, 2013).

Furthermore, many of them did not have a driving license and had to rely on their family members to send them for check-ups or to get medicines as mentioned by a respondent in the qualitative interview. This could be challenging for an individual with chronic diseases that required regular monitoring and check-up at the healthcare facility to ensure effective treatment and to prevent complications (WHO Regional Office for South-East Asia, 2013). Therefore, the knowledge of family members might also influence the decision on long-term disease management among diagnosed individuals. The support from first degree relatives and spouses was found to be essential in ensuring individuals with chronic diseases received the best disease management (Baanders & Heijmans, 2007; Limpawattana et al., 2013). Therefore, future studies can look into the health beliefs and behaviours of the family members

of NCDs patients to identify associated factors, beliefs, and practice that boost the support for patients with chronic diseases in the Orang Asli communities.

The decision in receiving modern treatment also influences an individual's attitude and acceptance towards modern medicine. One of the respondent's spouse had a fear of taking modern medication. The Orang Asli acceptance towards modern healthcare services is a more complex and is a multi-layered issue if compared to the other ethnicities because the Orang Aslis are profoundly influenced by their traditional health system, history, and other ongoing experiences (Aniza, Norhayati & Norfazilah, 2017; Wong, Allotey & Reidpath, 2019).

Some of the respondents mentioned the use of natural resources from their nearby forest as the supplementary energy drinks or treatment of illness. However, the use of natural resources was not only confined to that as traditional medicines were also used for the treatment of chronic diseases, including hypertension and DM. This study did not explore further the local knowledge on the use of natural resources to cure these chronic conditions. However, from the qualitative interview, the respondents reported on the use of roots of the woods from the nearby forest to treat high BP and high blood glucose. This practice was based on the knowledge they attained from the older generations.

One of the previous studies revealed the ethnomedicines used by the Temuan tribes in the suburban area of Gombak, Selangor (Azliza et al., 2012). Hypertension is the most treated ailment in which twelve species of natural resources were utilised. This highlighted the continuous custom of treating hypertensive diseases with natural remedies among the Orang Asli. The natural resources used included the roots of Tongkat Ali (*Eurycoma longifolia Jack*), Lebak Merah (*Tacca sp*. (Dioscoreaceae)), and Akar Segenuali (*Lasia sp.* (Araceae)).

Furthermore, Orang Asli patients with chronic diseases were often non-compliant to the regular check-up schedule given by healthcare practitioners. The nearest Klinik Desa to Kampung Ulu Kelaka was about 1.7 km away or 5 minutes by motorcycles. Despite the near distance, many of them defaulted. Forgetfulness was the common excuse for not going to the follow-up for disease monitoring, other than the use of traditional medicines.

The challenge faced by Orang Aslis in the treatment and monitoring of chronic diseases should be studied from a number of angles, including the factors of their reluctance, hesitation, and non-compliance. Understanding how communities engage with health systems can be a useful tool in describing how individuals engage with the services (MacKian, 2003). By combining quantitative and qualitative research data on health-seeking behaviour, researchers and the relevant stakeholders can explore the broader relationship between population and health systems development because the burden of chronic diseases is often not only at an individual level, but also at the levels of communities and nation in general (O'Cathain, Murphy & Nicholl, 2010; Shorten & Smith; 2017; Creswell & Hirose, 2019).

5.4 Implications of the Study

In this study, we have created a chronological record of all processes, including data collection and analysis for future reference and planning of intervention strategies which is available for use by other researchers. Based on this valuable research, the findings of the study outline the critical findings and the implications of the study.

To our knowledge, this is the first review to examine the prevalence of behavioural and metabolic risks of NCDs among the Orang Asli, which are the

minority population in Malaysia. For this systematic review, it's open up more opportunity for more evidence-based research on health vulnerability of Orang Asli to be conducted in the future.

For the mixed-method study, following to the WHO STEPwise approach surveillance of risk factors for NCDs, the findings from this study examining factors and barriers to NCDs thus proving information for policy-makers on the area which need immediate attention for the sustainability and well-being of the Orang Asli communities. Besides, information obtained from this study can be used as a reference for more research to be conducted in future.

The findings of this study help in screening those respondents who are having high blood pressure and hyperglycaemia. There is a concern of an under-reporting of NCDs among the Orang Asli. The study found high numbers of the respondent with unknown high blood pressure and high blood glucose. Therefore, results from this study highlight the essence of screening programs on NCDs at the community level in the Orang Asli populations.

The present study provides evidence on poor knowledge towards NCDs among Orang Asli. All the data gathered and the report from this KAP study would become a valuable baseline database, reference or support for medical, health care, psychological and social workers. This study also found that health awareness and education programs should focus not only on educating the diseases populations but also their spouse and first-degree relatives. The empowerment of individuals and families is essential to inculcate lifelong positive behaviours to prevent NCDs or delay the onset of complications.

The study findings have given impetus to some aspects of clinical practice. It is essential for all healthcare providers, who involved in providing services to the

Orang Asli communities, received adequate training. This study found that medical doctors would be the most influential persons in persuading people to change the health-seeking behaviour of Orang Asli towards modern medicine. The Orang Asli communities wanted clarification of their medical conditions so they can understand their health issues better and be more knowledgeable when addressing unhealthy lifestyle habits.

In addition, new information and insights into the difficulties experienced by Orang Asli in getting modern medical services, which might arise generalisable to the whole of Orang Asli communities were found. Despite being exposed to the fast-moving wheels of urbanisation, many Orang Aslis continue to be in low socioeconomic status. They need to be provided with proper facilities and health awareness to prevent NCDs-related health problems in their community.

Evidence including specific locales that are hazardous to health, topics of concern identified, at-risk population groups needing a government and Non Governments Organizations (NGOs), and also researchers health promotion programs. Detailed analysis of the present study is published nationally and internationally to inform policymakers, NGOs and researcher in the fields of health. Coordinated actions are needed to reduce NCDs and their risk factors. The data also be presented to the Ministry of Health for further utilization.

Apart from negative health consequences, the economic burden of chronic disease on the healthcare system is also escalating. The information from this study would be helpful in aiding the local health authorities to develop the right intervention strategies for the high-risk groups.

Furthermore, this study also helps to promote self-awareness among the Orang Asli so they can realize the importance of taking care of their health status. This is

also in line with the vision of JAKOA to assist an individual in achieving and sustaining as well as maintaining a certain level of health and well-being of Orang Asli. This thesis is a long-running health and human rights milestone kick-start move for the vulnerable indigenous community in Malaysia.

5.5 Strengths and Limitations of the Study

5.5.1 Strengths of this Study

This study benefited greatly from the use of the systematic review and mixed-methods sequential explanatory design as there are a few strengths that need to be highlighted in this study. First, a systematic review is characterised by being objective, systematic, transparent and replicable. We used the PRISMA Statement methodology for conducting systematic reviews. Thus, the study design used a sensitive and comprehensive search strategy, a duplicate and independent selection process, a duplicate and independent data abstraction process, and a rigorous appraisal of the methodological quality of included studies.

Secondly, multiple databases were searched. Also, reference lists of previous literature and review were searched. Besides, the Ministry of Health Malaysia also were contacted to attain any unpublished data. By doing so, it increases the effectiveness and efficiency of search methods.

Thirdly, the selection of studies was robust, with two reviewers independently assessing study eligibility and resolving disagreements by consensus by the third reviewer, which reduced the risk of selection bias. Then, the quality of the included studies were assessed by the Newcastle-Ottawa Quality Assessment Scale for cross-sectional studies. The methodological quality and limitations confronted by the

previous research give a rigorous study background for the future studies conducted among the Orang Asli.

Finally, the resulting information is particularly valuable for determining the prevalence of behavioural and metabolic NCDs risk factors among this population. And, therefore, identifying a lack of studies in these areas which need further action by all relevant party.

For the mixed methods study, firstly, this study has contributed vital information on the prevalence of NCDs and their relevant risk factors. Previous literature on this topic among the Orang Asli is very minimal. Such information is highly beneficial to future studies among the Orang Asli.

Secondly, the numbers of respondents considered acceptable as most of the previous studies among Orang Asli reported a low number of sample size. Due to the shy nature of the Orang Asli population and the small number of residents in each village, it is often hard to reach the people to be selected.

Thirdly, the mixed-methods design used in this study is ground-breaking and innovative. It incorporates the advantages of both quantitative and qualitative methods. Quantitative research provides data that are measurable, have rigour, hold internal validity, generalisable, and can be replicated. The data collected and analysed gave rise to questions that could not be answered using quantitative methods alone. Therefore, the use of qualitative studies conferred the extra advantages of flexibility in the research process, apart from providing a rich and detailed description that is valid and can compensate for the shortcomings of the quantitative methods. Had we used only one method, it would have been impossible to correlate the data on knowledge, attitude, and practices on NCDs and health-related behaviour.

In addition, mixed-methods design could counterbalance the weaknesses and draw on the strengths of each methodology. By corroborating the findings from both, a study would have greater validity. The benefit of mixed-methods design was evident in our study. The qualitative interview supported and complemented the quantitative results by allowing a more in-depth explanation of the beliefs, behaviours, and lifestyle habits of the respondents. These findings explained the reasons underlying the quantitative results and gave insight into the important aspects that must be considered when planning health awareness and intervention programs.

We believed that even though this study cannot be generalised to the whole Orang Asli population, it emphasises the need to look into better methods for implementation of NCDs intervention programmes, especially among the vulnerable Orang Asli communities. Future studies should also look for practical and innovative solutions to increase the knowledge of diseases and healthy behaviours among Orang Aslis to reduce their risks of developing NCDs.

5.5.2 Limitations of this Study

There are several limitations to this study that can affect the data in this study. Fist of all, systematic review, our assumption that meta-analysis would not be possible was confirmed by the disparate nature of the studies, and we were limited to narrative reporting of the results. Since the focus of the thesis was to integrate all previous research available on the Orang Asli population, no detailed propositions linking the elements, including the sociodemographic factors that might have influenced the outcome, i.e. the prevalence were presented. Therefore, the findings cannot be generalised to all Orang Asli populations as some studies focused only on

specific Orang Asli populations, and some other studies did not report the Orang Asli tribe that was studied.

Secondly, in order to reach maximum recall, searches in systematic reviews ought to include a combination of databases. The findings in our systematic review are, however, limited by our electronic search strategy that used specific search terms and databases within the study period. In this review, we had four databases, including MEDLINE/Pubmed and CINAHL, which is the most frequently used databases for systematic reviews. The limited number of databases might limit the searches of relevant articles were not published in this peer-reviewed journal covers in these four databases. This limitation was recounted through the snowballing of references to gather any publication that not included in the databases.

Thirdly, the number of studies in this review was low with limited methodological quality. Although some studies used robust population-sampling techniques, the majority of the studies applied convenience sampling. In addition, majority of the studies also used different measures of risk, thus influencing the number of outcomes. Thus, making it difficult to compare between the studies. Our assumption that meta-analysis would not be possible was confirmed by the disparate nature of the studies, and thus, we were limited to narrative reporting of the results.

And finally, there is a possibility that the search strategy could have missed certain relevant studies. Some Orang Asli tribes that represented the same group might have different names due to the language differences. We used a comprehensive list of search terms concerning to all Orang Asli tribe and sub-tribe. However, because of vocabulary differences in some of the specific indigenous group names, studies involving them might not have been indexed according to the general

vocabulary. Moreover, those that might have only used the particular name of the investigated tribe or group might not be detected.

Despite the limitations, within this time limit we believe that the rigorous procedure of this systematic review, including the use of reference citation, managed to reduce the probability of omitting any research that would have contained data that could critically mislead the conclusion.

Whereas, for the field research conducted among Temuan Proto-Malay Orang Asli, during the interview session, all the information obtained was self-reported by the respondents excepts for the major NCDs diagnosis. Thus, social desirability bias might exist as they gave untrue but favourable responses regarding their practice. Some of them appeared to be less sincere and tended to lie about their answers. Therefore, this psychological barrier may limit the accuracy of the data obtained in the research.

Furthermore, the screening of NCDs risk behaviours was not done with a standardised questionnaire. As a result, the analysis of smoking habits, alcohol intake, physical activity, exercise habits, and food quantities might have been compromised. As some of the respondents had no medical background and could have been confused by the terminology used.

In addition, a lack of genuine communication between the Orang Asli and the interviewers may occur as some of them were shy or suspicious during the interview. Some of them even moved away when approached by the interviewers whom they perceived to be outsiders. Even though a token of appreciation was offered by the interviewer, they were reluctant to participate in this survey. During the interview process, an interviewer will probe more in-depth on the data being collected. The used

of the same group of interviewer throughout the data collection process, also allowing the interviewer to gain skill in conducting the interview.

Another limitation is the unexpected disproportionate number between males and females. The predominance of females could have led to study bias. The low number of males could be due to the fact that they needed to work on weekdays during the interview time from 9 a.m. to 5 p.m. The restriction in interview duration was due to safety reason.

Overall, the result of our study does not represent the whole NCDs risks and health behaviour situation of the Orang Asli, Malaysia. This is due to the study only conducted at a selected area of Jelebu, Negeri Sembilan and which has only emphasized the following ethnic groups of the Temuan. It is just one amongst the six subgroups of Proto-Malay. As indicated in the literature, there are another two main groups of Orang Asli Negrito and Senoi with each group comprises six sub-groups that may have different healths behaviour risks and cultural norms which may not be generalised.

5.6 Summary of the Chapter Five

The findings discussed here have improved our understanding of adults Orang Asli risks and health behaviours towards NCDs. It supported the literature on the worryingly high rate of NCDs among these vulnerable communities shown in the systematic review. The study also reported that there were associations between risk factors with major NCDs. Besides, the KAP was low as supported by qualitative findings. There were also common barriers in health-seeking response despite their high rate of Orang Asli using the modern health care facility. Qualitative data

complemented our quantitative findings and provided a better understanding of research in terms of the reasons for this barrier.

The study findings imply all relevant party in constructing and developing promotion and prevention programs that aim to reduce the NCDs burden in the community. The study findings also contributed to the existing body of knowledge on NCDs risk, KAP towards the diseases and their health behaviour. By doing so, more research and education is crucial to support the sustainability of this marginalised community. However, due to the study limitation, the findings must be interpreted with caution.