



UNIVERSITI PUTRA MALAYSIA

***FACTORS ASSOCIATED WITH HAEMOGLOBIN LEVEL AT THIRD
TRIMESTER OF PREGNANCY AMONG PREGNANT WOMEN IN
KAJANG, SELANGOR***

VIVIANA ROBERT LOJONON

**Ip
FPSK3 2020 19**

DECLARATION

I declare that this project is my original work and ideas except for quotations and citations, which have been fully acknowledged.



VIVIANA ROBERT LOJONON

Matric Number: 189135

Bachelor of Science (Nutrition and Community Health)

Faculty of Medicine and Health Sciences

Universiti Putra Malaysia

This project entitled “Factors Associated with Haemoglobin Level at Third Trimester of Pregnancy Among Pregnant Women in Kajang, Selangor” was prepared by Viviana Robert Lojonon and submitted to the Faculty of Medicine and Health Sciences as a partial fulfillment of the requirement for the degree of Bachelor of Science (Nutrition and Community Health) from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia (UPM).



Received and examined by:

(Y.Bhg. Prof. Dr. Zalilah binti Mohd Shariff)

Date:

ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest gratitude to the Almighty God for giving me the blessings, determination, and wisdom to accomplish this work.

Next, I would like to express my sincere gratitude to my supervisor, Y. Bhg. Prof. Dr. Zalilah binti Mohd Shariff for all the endless guidance, constructive comments and support throughout the research. Besides, I also would like to express my gratitude to Dr Siti Raihanah Shafie, the coordinator of course PKK4999A and PKK4999B for her guidance throughout this course. I would like to express my appreciation to Dr. Yong Heng Yaw, and all nurses in KK Kajang for their assistance and cooperation accorded to me during my data collection. I also thank the participants who agreed to be part of the research.

Apart from that, I owe more than thanks to my family members that had always given me the encouragement, financial, physical, emotional and moral support. Last but not least, I owe my deepest gratitude to my FYP mate, Nursyuhada binti Basir and my course mate for their support, encouragement and assistance.

TABLE OF CONTENTS

<u>Contents</u>	<u>Page</u>
TITLE PAGE	i
DECLARATION	ii
SUPERVISOR'S SIGNATURE	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF APPENDICES	viii
ABSTRACT	ix
ABSTRAK	x
CHAPTER 1: INTRODUCTION	
1.1 Background	1
1.2 Problem Statement	4
1.3 Significance of the study	7
1.4 Objectives	
1.4.1 General Objective	8
1.4.2. Specific Objectives	8
1.5 Hypotheses	9
1.6 Research Conceptual Framework	10
CHAPTER 2: LITERATURE REVIEW	
2.1 Anaemia	12
2.2 Iron Intake	14
2.3 Factors Associated With Haemoglobin Level In Pregnancy	
2.3.1 Demographic and Socio-economic Factors	15
2.3.2 Obstetric Factors	19
2.3.3 Dietary Iron Intake	23
2.3.4 Iron Supplementations	24
CHAPTER 3: METHODOLOGY	
3.1 Study Design	25
3.2 Study Location	25
3.3 Sample size determination	26

3.4	Study Subjects	28
3.5	Sampling Design	29
3.6	Measurements	
3.6.1	Demographic and socio-economic characteristics	30
3.6.2	Obstetric history	30
3.6.3	Dietary assessment	31
3.6.4	Iron supplementation	34
3.6.5	Haemoglobin level	35
3.7	Pre-testing	35
3.8	Data Collection	36
3.9	Data analysis	36
3.10	Ethics Approval	37

CHAPTER 4: RESULT AND DISCUSSION

4.1	Characteristics of the respondents	
4.1.1	Demographic and socio-economic characteristics	38
4.1.2	Obstetric characteristics	41
4.1.3	Dietary iron intake	43
4.1.4	Iron supplementations	44
4.1.5	Prevalence of anaemia	46
4.2	Factors associated with haemoglobin level at third trimester of pregnancy	
4.2.1	Association between demographic and socio-economic factors and haemoglobin level	47
4.2.2	Association between obstetric factors and haemoglobin level	50
4.2.3	Association between dietary iron intake and haemoglobin level	53
4.2.4	Association iron supplementation and haemoglobin level	54

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1	Conclusion	56
5.2	Limitations	58
5.3	Recommendations	59

REFERENCES	60
-------------------	----

APPENDICES	68
-------------------	----

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
Table 3.1	Calculation of sample size	27
Table 3.2	WHO asian BMI classifications	31
Table 3.3	Formula to calculate the amount of daily food intake	32
Table 3.4	Conversion factors for frequency of food intake	32
Table 4.1	Demographic and socio-economic characteristics of the respondents	40
Table 4.2	Obstetric characteristics of the respondents	42
Table 4.3	Characteristics of dietary iron intake of respondents	43
Table 4.4	Characteristics of iron supplementations	45
Table 4.5	Anaemic status and severity of anaemia	46
Table 4.6	Association between demographic and socio-economic factors and haemoglobin level at third trimester of pregnancy	49
Table 4.7	Association between obstetric history and haemoglobin level at third trimester of pregnancy	52
Table 4.8	Association between dietary iron intake and haemoglobin level at third trimester of pregnancy	53
Table 4.9	Association between iron supplement and haemoglobin level at third trimester of pregnancy	55

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
Figure 1.1	Conceptual framework of the study	10
Figure 3.1	Flow chart of sampling design	29

LIST OF APPENDICES

<u>Appendix</u>	<u>Title</u>	<u>Page</u>
Appendix A	Approval from MREC	68
Appendix B	Respondents' Information Sheet and Consent form	70
Appendix C	Questionnaire	78

ABSTRACT

FACTORS ASSOCIATED WITH HAEMOGLOBIN LEVEL AT THIRD TRIMESTER OF PREGNANCY AMONG PREGNANT WOMEN IN KAJANG, SELANGOR

Viviana Robert Lojonon

Anaemia in pregnancy remains a major health problem with adverse maternal and fetal outcome worldwide. It affects not only to the mothers but to the fetus as well which result into high maternal morbidity and mortality. In Malaysia the prevalence of anaemia among pregnant women was 37.10% (World Health Statistics, 2016). This cross-sectional study aimed to determine factors associated with haemoglobin level at third trimester of pregnancy among pregnant women in Kajang, Selangor. This study was conducted at Klinik Kesihatan Kajang, Selangor. A total of 103 pregnant women fulfilled the inclusion criteria were recruited and interviewed. A set of questionnaires were used to collect data on demographic and socio-economic backgrounds, dietary iron intakes, and iron supplementation intake of the pregnant women while the obstetric history and haemoglobin level were obtained from antenatal record. Dietary iron intake was assessed using a Semi-Quantitative Food Frequency Questionnaire. SPSS version 22.0 were used to analyse all the data. Chi-square test was used to determine the association between independent variables and haemoglobin level. Out of 103 pregnant women, the prevalence of anaemia during pregnancy in third trimester was 28.2%. Among the anaemic respondents, 65.5% and 34.5% of them were mild and moderate anaemia respectively. The mean age was 30.27 ± 4.95 years old. Majority of them were Malay (87.4%), 67% were with tertiary level of education, 55.3% were employed with a mean monthly household income of $\text{RM}4135.92 \pm 2275.40$. In addition, 60.2% of them were multigravida, 83.5% had no history of anaemia in previous pregnancy, and 33.9% had their birth spacing lesser than 2 years. The mean pre-pregnancy BMI was $22.32 \pm 4.04 \text{ kg/m}^2$ where majority of them had a normal weight (60.2%). The mean dietary iron intake was 18.23 ± 14.96 mg which was below the recommendation. More than half of the respondents took iron supplement and consumed it daily. Result showed that secondary education level ($p=0.006$), history of anaemia in previous pregnancy ($p<0.001$), and pre-pregnancy BMI ($p=0.006$) were significantly associated with haemoglobin level. In conclusion, the prevalence of anaemia in pregnancy was 28.3%. Reproductive advice and education are needed to be given among pregnant women to create awareness about the risk of developing anaemia and as well as emphasize the important of iron-rich foods during pregnancy, healthy weight management and oral supplementation to prevent the onset of anaemia in pregnancy.

ABSTRAK

FAKTOR-FAKTOR YANG BERKAITAN DENGAN TAHAP HEMOGLOBIN PADA TRIMESTER KETIGA SEMASA HAMIL DALAM KALANGAN WANITA MENGANDUNG DI KAJANG, SELANGOR

Viviana Robert Lojonon

Anemia semasa hamil masih lagi menjadi salah satu faktor yang terbesar yang memberi kesan kepada kesihatan ibu dan janin. Ia boleh mengakibatkan kematian kepada ibu dan janin. Di Malaysia, prevalen anemia di kalangan ibu mengandung adalah 37.10% (World Health Statistics, 2016). Kajian kertas keratin telah dijalankan dengan bertujuan untuk menentukan faktor-faktor yang berkaitan dengan anemia semasa mengandung di kalangan ibu hamil di Kajang, Selangor. Kajian ini dilaksanakan di Klinik Kesihatan Kajang, Selangor. Sejumlah 103 ibu hamil terlibat dalam kajian ini. Satu set borong soal selidik telah digunakan untuk memperolehi data berkaitan latar belakang sosio-ekonomi dan demografi, pengambilan pemakanan, dan pengambilan suplementasi wanita hamil manakala rekod sejarah obstetrik telah diperolehi daripada rekod pranatal. Borang Keperluan Pengambilan Makanan Semi Kuantitatif telah digunakan untuk mendapatkan maklumat pengambilan zat besi. Ujian Chi Square digunakan untuk menentukan hubungan antara pembolehubah bebas dan GDM. Data-data yang diperolehi dianalisa menggunakan SPSS version 22.0. Ujian Chi Square digunakan untuk menentukan hubungan antara pembolehubah bebas dan tahap haemoglobin. Daripada 103 ibu hamil, terdapat 28.2% ibu hamil yang mempunyai anemia. Di antara ibu hamil tersebut, 65.5% daripada mereka mengalami anemia ringan dan 34.5% mengalami anemia sedang. Umur purata mereka ada 30.27 ± 4.95 tahun. Majoriti daripada mereka adalah berbangsa Melayu (87.4%), mempunyai tahap pendidikan tertiary (67%), mempunyai pekerjaan (55.3%) dengan purata pendapatan bulanan isi rumah RM 4135.92 ± 2275.4 . Selain itu, 60.2% daripada mereka adalah multigravida, 83.5% tidak mempunyai latar belakang anemia semasa kandungan yang lepas, dan 33.9% mempunyai jarak kelahiran anak kurang daripada 2 tahun. Purata BMI pra-kehamilan $22.32 \pm 4.04 \text{ kg/m}^2$ di mana majoriti mereka mempunyai berat yang normal (60.2%). Purata pengambilan zat besi dari pemakanan adalah $18.23 \pm 14.96 \text{ mg}$ di mana ia tidak mencapai tahap rekomendasi yang disarankan. Lebih daripada separuh ibu hamil yang mengambil suplemen zat besi setiap hari. Keputusan menunjukkan tahap pendidikan ($p=0.006$), mempunyai latar belakang anemia semasa kandungan yang lepas ($p<0.001$) dan BMI pra-kehamilan ($p=0.006$) menunjukkan hubungan yang signifikan dengan tahap hemoglobin. Kesimpulannya, 28.3% ibu hamil mengalami anemia. program intervensi perlu dilaksanakan untuk ibu hamil agar mereka mempunyai kesedaran tentang kesan buruk anemia dan mempunyai pengetahuan tentang kepentingan memakan makanan yang tinggi zat besi semasa hamil, pengurusan berat badan sebelum hamil dan pengambilan suplemen zat besi untuk menghindari daripada anemia semasa hamil.

CHAPTER 1

INTRODUCTION

1.1 Background

Iron is an essential metal for humans. There are several vital functions of iron in human body. In red blood cells of human body, iron plays an important role as a carrier of oxygen from the lungs to the tissues. Besides that, iron also become a transport medium within the cells of human body for electron. Not only that, in various tissues of human body, iron become as an integrated part of essential enzyme systems (Gupta, 2014). According to Milman et al. (2015), the human body activates hundreds of iron-containing metalloenzymes in which iron is essential to be present. Amongst the most important are ribonucleotide reductase, which is needed for cell proliferation and DNA synthesis, the cytochromes, which involved in electron transport and ATP synthesis. In human body, roughly 70 percent of the iron are located in the red blood cells called haemoglobin (Hb). Therefore, iron plays an essential role in maintaining the function of all cells and organs in the human body. Iron status can be considered as a continuum from iron deficiency with anaemia, to iron deficiency with no anaemia, to normal iron status with varying amounts of stored iron, and finally to iron overload which can cause organ damage when severe (WHO, 2001). The World Health Organization defined anaemia as “a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient

to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status” (WHO, 2008). Whereas, anaemia in pregnancy is defined as “a condition in which the haemoglobin level of a woman during pregnancy is <11 g/dl” (WHO, 2011)”.

Anaemia can occurs at all stages of the life cycle, however the risk of having anaemia are higher in state of pregnancy due to an increased physiological demand, iron requirement, blood loss and possible infections (Yulianti et al., 2014). There are three classifications of anaemia during pregnancy and it is characterized by the criteria of haemoglobin (Hb) level. Based on World Health Organization, anaemia in pregnancy is classified severe when haemoglobin level is less than 7.0 g/dl, moderate when the haemoglobin level is 7.0 to 9.9 g/dl, and mild when haemoglobin level is 10.0 to 10.9 g/dl (WHO, 2011). WHO (2016) has recognized anaemia as a global problem with serious consequence for the mothers and babies. The effects of anaemia in pregnancy not only towards the mother but it effects towards the fetus as well such as higher rate of mother or fetus morbidity and mortality, preterm delivery, low birth weight, preeclampsia, and higher risk of miscarriage (Lestari et al., 2018; Lin et al., 2018; Singal et al., 2018).

In the year 2011, the World Health Organisation estimates about 38% of pregnant women were anaemic globally (WHO, 2011). The highest prevalence of anaemia is in South-east Asia and Africa, with rates of 48.7% and 46.3%, respectively (WHO, 2011). It is estimated that anaemia contributes to more than 115000 maternal deaths and 591000 prenatal deaths globally per year (Salhan et al., 2012). Although anaemia is a global public health problem that affects both developed and developing countries with major consequences for human health as

well as social and economic development, its burden is more significant in developing countries. According to Karaoglul et al. (2010), anaemia in pregnant women remains as one of the most unresolved public health problems in developing countries because of various socio-cultural problems such as illiteracy, poverty, lack of awareness, cultural and religious taboos, poor dietary habits, and high prevalence of parasitic infestation. According to the World Health Statistics, the prevalence of anaemia among pregnant women in Malaysia in 2016 was 37.10% (WHO, 2016). In the Annual Report Ministry of Health (2017), the prevention and control programme for anaemia in Malaysia has been one of the Quality Assurance Indicator for National Indicator Approach in Ministry of Health since 2015. The percentage of anaemic pregnant mothers at ± 36 weeks is the indicator that is monitored by all Health State Department in this Quality Assurance (QA) process. In the process of the evaluation process of QA, several intervention programmes at state or district level have been implemented to address local anaemia issues. In general, for both prophylactic and curative measures, pregnant women were given haematinics with iron (ferrous fumarate), folic acid, vitamin C and vitamin B Complex. In addition, health education and nutrition counselling were provided as well to pregnant women to encourage them to consume food high in iron and to increase vitamin C intake in daily diet.

1.2 Problem Statement

Anaemia during pregnancy has a variety of causes and contributing factors. It is important to identify the factors associated with anaemia in order to plan for strategies and intervention to reduce the prevalence of anaemia. Although demographic and socio-economic factors are important determinants of anaemia, there were few studies had inconsistent findings in relation to anaemia in pregnancy. According to Wright et al. (2017), younger mothers below 35 years old were more likely to be anaemic compared to those ≥ 35 years old. Similarly, Ahenkorah et al. (2016) found a significant association between younger maternal age and anaemia. On the contrary, studies conducted in Ethiopia and China showed that the prevalence of anaemia was highest among older women (≥ 30 years old) (Alemu et al., 2015; Zhang et al., 2009). Besides, other studies found that there was no significant association between socio-demographic factors such as age, education level, occupation, and socio-economic status with anaemia (Vindhya et al., 2019; Lestari et al., 2018; Sholeye et al., 2017)

Obstetric history is also a main factor associated with anaemia. According to Lestari et al. (2018), pregnant women with parity more than twice were more likely to develop anaemia. Multipara mothers had higher risk of having anaemia due to decreased maternal iron reserves at every pregnancy and blood loss at each delivery (Karaoglu et al., 2010). In addition, multigravida women were likely to developed anaemia compared to primigravida women as a consequence of depletion of iron reserves owing to repeated pregnancies (Ali et al., 2019; Vindhya et al., 2019). However, Stephen et al. (2018) reported that gravidity and parity were not associated with anaemia.

Inconsistent findings can also be observed in the association between dietary iron intake and anaemia. According to Suryanarayana et al. (2019), the high prevalence of anaemia can be attributed to low dietary intake of iron. This finding is consistent with a study conducted by Zekarias et al. (2017) in which with pregnant women who consumed less iron sources such as meat less than once per week were more likely to developed anaemia in pregnancy (Zekarias et al., 2017). In addition, Lesbo et al. (2017) showed that pregnant women not consuming iron-rich food were more likely to develop anaemia. However, Hasswane et al. (2015) reported that low meat consumption was not associated with development of anaemia in pregnancy.

As a part of antenatal care, it is important to take daily oral supplementation to reduce the risk of low birth weight, maternal anaemia and iron deficiency (WHO, 2012). According to Lebso et al. (2017), pregnant women who did not consume iron supplements showed a statistically significant association with anaemia. Gebreweld and Tsegaye (2018) found that pregnant women who did not consume iron supplements were more likely to be anaemic when compared to pregnant women who did take supplementation. Pregnant women who did not consume iron supplementation during pregnancy had increased risk of developing anaemia compared to those who consumed iron supplementation (Bekele et al., 2016). Whereas, Stephen et al. (2018) showed no association between iron supplementation and the development of anaemia.

As these studies showed inconsistent findings on the associations between socio-demographic factors, obstetric history, dietary iron intake, iron supplementation and haemoglobin level, more studies are needed to be conducted. World Health Organization report states that anaemia in pregnancy peaks in the third trimester (WHO, 2012). Thus, this study aimed to identify factors associated with haemoglobin level at the third trimester of pregnancy among pregnant women and attempted to answer the following research questions:

1. What is the haemoglobin level at the third trimester of pregnancy among pregnant women attending antenatal care at Klinik Kesihatan Kajang, Selangor?
2. What are the factors associated with haemoglobin level at the third trimester of pregnancy?

1.3 Significance of The Study

Anaemia is a significant maternal health problem during pregnancy. It is associated with a negative outcome for both mother and the offspring. This study was conducted to further clarify the factors which contribute to the high occurrence of anaemia among pregnant women in Malaysia, specifically in Selangor. The study findings could assist Ministry of Health, relevant authorities and agencies to develop policies in order to justify the needs of providing health and nutrition interventions for pregnant women. Besides, the study findings could assist health professionals and educators to design intervention programs and target modifiable factors associated with anaemia in pregnancy. The findings from this study can also be used by other researchers for future research in Malaysia. In addition, having a better understanding of haemoglobin level at third trimester of pregnancy and the factors that contribute to it will be useful for pregnant women in ensuring their pregnancies are safe and healthy.

1.4 Objective of The Study

1.4.1 General Objective

To determine the factors associated with haemoglobin level at third trimester of pregnancy among pregnant women attending antenatal care at Klinik Kesihatan Kajang, Selangor.

1.4.2 Specific Objectives

1. To determine demographic and socio-economic factors, obstetric history, dietary iron intake, and iron supplementation of pregnant women.
2. To determine haemoglobin level at third trimester of pregnancy among pregnant women.
3. To determine the association between
 - a) demographic and socio-economic factors
 - b) obstetric history
 - c) dietary iron intake
 - d) iron supplementationand haemoglobin level at third trimester of pregnancy among pregnant women.

1.5 Hypothesis

H₁: There are associations between demographic and socio-economic factors (age, ethnicity, education level, employment status, and household monthly income level) and haemoglobin level at third trimester of pregnancy.

H₂: There are associations between obstetric history (parity, gravidity, history of anaemia in previous pregnancy, birth interval and pre-pregnancy BMI) and haemoglobin level at third trimester of pregnancy.

H₃: There is an association between dietary iron intake and haemoglobin level at third trimester of pregnancy.

H₄: There are associations between iron supplementation (intake of iron supplement, frequency of intake and dosage (elemental iron intake)) and haemoglobin level at third trimester of pregnancy.

1.6 Conceptual Framework

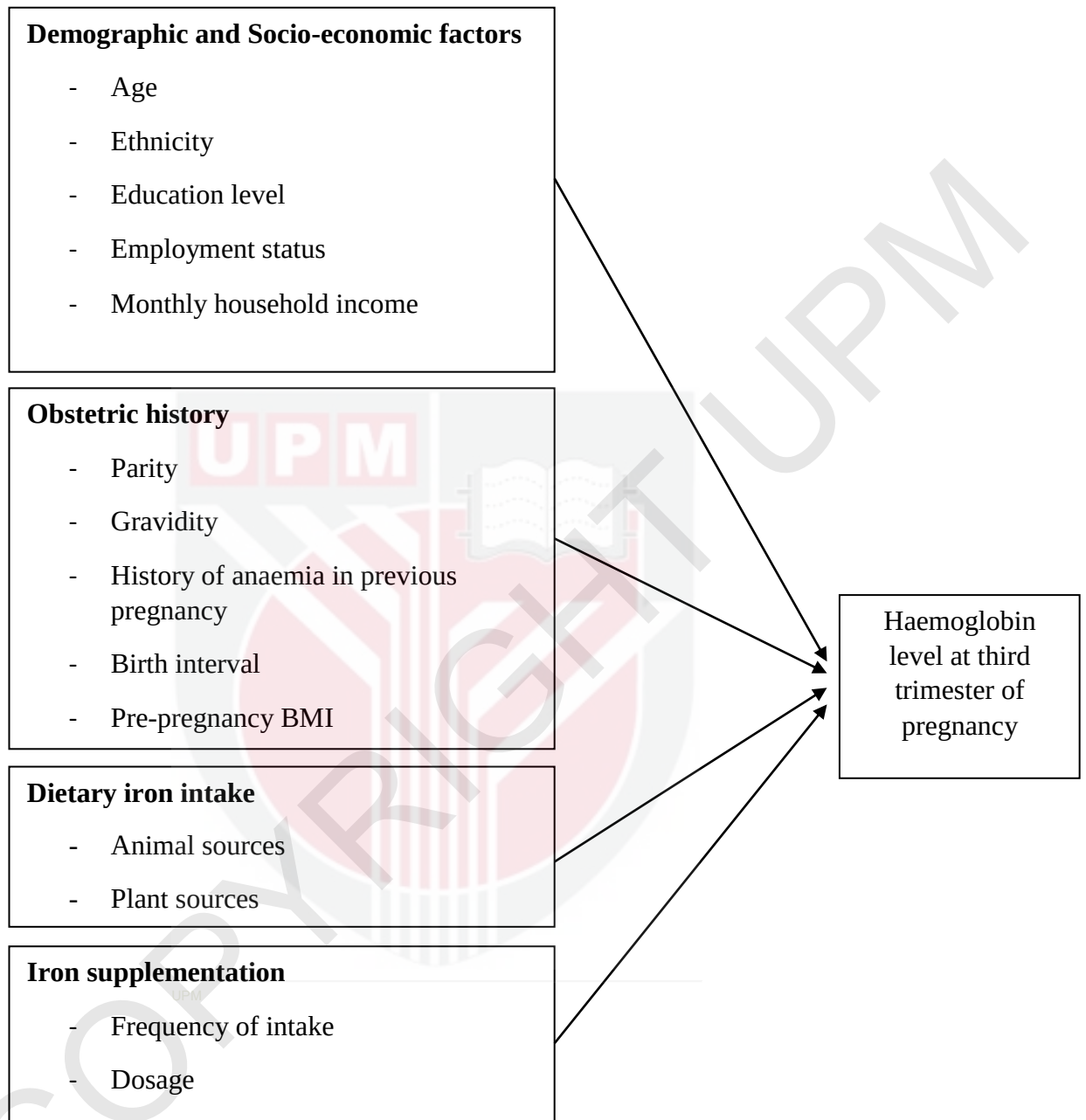


Figure 1.1: Conceptual framework of the study

Figure 1.1 shows the conceptual framework of the study that consists of four independent variables and one dependent variable. The independent variables are demographic and socio-economic factors, obstetric history, dietary iron intake, and iron supplementation while the dependent variable is the haemoglobin level at third trimester of pregnancy. Haemoglobin level is an indicator of anaemia in pregnancy among pregnant women. Demographic and socio-economic status can influence the status of anaemia in pregnancy. Recent studies found that age and education level showed statistically significant relationship with anaemia (Chowdhury et al., 2015; Mekonnen et al., 2018; Ndegwa et al., 2019;). Moreover, obstetric history, which consists of haemoglobin level at booking, parity, gravidity, history of anaemia in previous pregnancy, and inter-interval pregnancy is also related to anaemia. For example, pregnant women with multiparity and multigravida increased the risk of developing anaemia (Ali et al., 2019; Leyla et al., 2010). Dietary iron intake is important in ensuring pregnant women get enough iron in their body to prevent from developing anaemia. There was a strong association between dietary practices and the prevalence of anaemia in those pregnant women who did not consume iron rich food were more likely to develop anaemia (Ndegwa et al. 2019; Lesbo et al., 2017). Besides that, iron supplementation is also a risk factor for anaemia in pregnancy. Pregnant women who did not consume iron supplementation were more likely to be anaemic when compared to pregnant women who consumed iron supplementation (Bekele et al., 2016; Gebreweld et al., 2018).

CHAPTER 2

LITERATURE REVIEW

2.1 Anaemia

Anaemia in general is defined as “a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status” (WHO, 2008). Whereas, anaemia in pregnancy is defined as “a condition in which the haemoglobin concentration of a woman during pregnancy is <11 g/dL” (WHO, 2011). Anaemia is characterized by the criteria of haemoglobin (Hb) level, in which they are considered as anaemic if the Hb level of women of reproductive age is <12.0 g/dL, the Hb level of pregnant women on the first and third trimester is <11 g/dL and Hb level on the second trimester is <10.5 g/dL, whilst pregnant women with Hb level ≥ 11 g/dL is categorized as non-anaemic (WHO, 2011). Anaemia in pregnancy is further categorized into 3 levels of severity based on the level of Hb. Anaemia is categorized as severe when the haemoglobin level is less than 7.0 g/dL, moderate when the haemoglobin level is between 7.0 to 9.9 g/dL, and mild when haemoglobin level is between 10.0 to 10.9 g/dL (WHO, 2011).

The World Health Statistics data shows that the prevalence of anaemia in pregnancy was 40.1% worldwide (World Health Statistics, 2016). Meanwhile, the prevalence of anaemia in pregnancy in Malaysia was 29.3%. Sabah and WP Labuan have the highest prevalence (46.8%), followed by Melaka (43.5%), Johor (34.3%), Selangor (33.3%), Terengganu (31.3%), Sarawak (30.2%) and the rest of states were with prevalence below 20% (The National Health and Morbidity Survey, 2016).

Iron Deficiency (ID) was identified as one of the most common causes of anaemia. A person will be diagnosed as having ID when the serum ferritin is $<15\text{-}30\text{ }\mu\text{g/L}$ and serum transferrin saturation $<20\%$. When the erythropoiesis is severely decreased due to ID, Iron Deficiency Anaemia (IDA) will occur. A person will be diagnosed as having IDA when the serum ferritin is $<12\text{-}15\text{ }\mu\text{g/L}$ and serum transferrin saturation $<15\text{-}16\%$ (Milman, 2015). The consequences of IDA during pregnancy is it increases the risk for the mothers to have pre-term delivery and for baby to be born in small condition. Small or pre-term babies are more prone to have health problems. It can cause death in the first year of life as compared to the infants who are born full-term and not small (Symington, 2019).

2.2 Iron Intake

During pregnancy, the iron requirements for the mothers are increased. High requirement of iron is due to have a sufficient iron to supply to the placenta and fetus that are growing and for the production of increased numbers of maternal red blood cells. Generally, in adult women, the recommended iron intake is 14.8 mg per day (RNI, 2017). In pregnancy, the Dietary Reference Value (DRV) panel did not establish any increment, as additional iron requirements were considered to be met through cessation of menstrual loss, increased intestinal absorption and mobilization of maternal iron stores (Williamson, 2006). Hence, this study refers to the recommendation by American Pregnancy Association (APA) which is the recommended intake of iron for pregnant women is 27 mg per day and it can be consumed from beef, dried beans, spinach, dried fruits, wheat germ, oatmeal or grains fortified with iron (APA, 2012). There are two types of iron in foods which are heme iron and non-heme iron. Heme iron is derived primarily from the haemoglobin and myoglobin of flesh foods such as meats, fish, and poultry. Meanwhile, non-heme iron is found in plant foods such as breads, cereals, legumes, and dark leafy vegetables such as spinach and fern shoots (RNI, 2017)

2.3 Factors Associated with Haemoglobin Level in Pregnancy

2.3.1 Demographic and Socio-economic Factors

i. Maternal age

Significant connection between maternal age and anaemia had been discovered in various studies in the past. A study by Lin et al. (2018) reported that among 26,255 pregnant women in China maternal age above 35 years old (AOR = 1.39, 95% CI:1.10-1.74) was significantly associated with anaemia. The findings were similar with the study conducted by Siddiqui et al. (2017) in which older pregnant women have a higher burden of anaemia than younger ones. However, a cross-sectional survey that involved 293 pregnant mothers in Western Jamaica showed younger age group between 18–24 years old (OR: 2.93, 95% CI: 1.06–8.09) has more risk of developing anaemia (Wright et al., 2017). Meanwhile, a study conducted on the prevalence and risk factors of anaemia among pregnant women attending a public-sector hospital in Bangalore, South India, reported that no significant association between age and anaemia in their studies (Vindhya et al., 2019). Similarly, a study conducted by Asrie (2017), shared that there was no significant association between maternal age and anaemia.

ii. Ethnicity

A local cross-sectional study on anaemia during pregnancy, involved 1,072 Malaysian pregnant women showed that ethnicity was associated with anaemia in pregnancy and Malay mothers (36%) and Indian mothers (37%) were equally affected. Meanwhile, Chinese had a lower prevalence of anaemia because of their serum ferritin and haemoglobin levels were higher as compared to the other races (Goh et al, 1986; Haniff et al., 2007). Another study conducted at the Antenatal Clinic of University Malaya Medical Centre by Albert et al. (2014) showed that Indian were more prone to have the highest prevalence of anaemia. Out of 120 respondents, 28.3% of the Indian population were anaemic, followed by 21.9% of the Chinese population and 16.1% of the Malay population. Similarly, to a Singapore study done by Loy et al. (2019) reported that Malay and Indian were more likely to develop anaemia than Chinese pregnant women. This is due to the differences in dietary practice or iron absorption among ethnics. Commonly in the Chinese community, they consume a rich source of haem-iron with a higher bioavailability such as more egg, meat and poultry, whereas Malay women reported to consumed less fruits and vegetables as well as low vitamin C intake, which cause the iron absorption decrease. Whilst, Indian women tend to be vegetarian in which non-haem will be the main type of iron they consume. However, the phytates present in vegetables and cereals might inhibit the absorption of non-haem, which can lead to the development of anaemia.

iii. Education Level

A follow-up study conducted from October 2013 to June 2015 by Stephen et al. (2018) reported that the low education level of women was associated with anaemia during pregnancy ($p=0.022$). Out of 539 pregnant mothers that were involved in this study, 18% of them were anaemic. Among those anaemic ladies, 19.1% were with primary education level. Women with secondary education or higher had 76% less odds of having anaemia compared to others. Similarly in Singal et al. (2018) study, 200 of respondents that had moderate and severe anaemia were included in the study. This study reported that the prevalence of anaemia was high among illiterate mothers. There were 126 (63%) anaemic pregnant mothers, among a total of 200 respondents and 33% of the anaemic pregnant women had only school education. A similar finding was also found in studies conducted Soh et al. (2015) and Suryanarayana et al. (2019) in which education level was significantly associated with haemoglobin level, and the majority of the anaemic respondents were with secondary education. According to Noviyanti et al. (2019), anaemic pregnant women with low education have a higher prevalence than highly educated mothers. This is because mothers with higher education level are more concerned about their health and the health of their foetus, have more awareness about the dangers of anaemia hence they will maintain their Hb level in the normal range, have better income and eat nutritious food (Soh et al., 2015; Stephen et al., 2018).

iv. Employment Status

El-Sherbiny et al. (2015) study reported 76.3% from 381 pregnant women at their third trimester were suffering from anaemia. This study revealed that the risk of an unemployed pregnant woman was 2.27 (CI 1.29–3.99) times greater than those with a job. Another study conducted by Xu et al. (2016) involved 2345 pregnant women from 16 hospitals in Mainland China showed that the prevalence of anaemia was at 12.7%. It was noted that pregnant women with manual jobs (OR 1.70, 95% CI 1.17–2.45) and unemployed (OR 1.42, 95% CI 1.04–1.93) were at higher risk of developing anaemia.

v. Monthly Household Income

Based on the study done in China by Xu et al. (2016), higher income was less likely to develop anaemia during pregnancy (OR 0.68, 95% CI 0.50–0.94) compare with women of low income (<¥4,500). According to the cross-sectional study conducted in Wolayita Sodo Otona Hospital done by Gedefaw et al. (2015), 145 (39.94%) pregnant women were anaemic. This study revealed that low income (AOR:5.81, 95%CI:2.93-14.11) which income less than 968 ETB was independent predictors of anaemia among pregnant women. Status of family income plays a major role in ensuring proper health among vulnerable groups. Apart from that, a cross-sectional study was conducted by Bekele et al. (2016) reported that there was significant association between monthly household income and anaemia in pregnancy. This is because pregnant women with low income were at risk of anaemia;

could not get adequate nutrition, do not have the ability to buy quality and quantity of food.

2.3.2 Obstetric History

i. Parity

Parity is defined as the number of births after the 20th of gestation (Cox, 2005). Lestari et al. (2018) conducted a cross-sectional study which involved 140 pregnant women to determine the prevalence of anaemia in pregnant women and the risk factors associated with anaemia in urban and rural areas of North Sumatera Province. The study revealed that 40.7% were anaemic and was multiparity. Pregnant women with parity > 2 times had higher risk to develop anaemia (16 women, 57.1%) than pregnant women with parity $\leq$ 2 (41 mothers, 36.6%). Apart from that, El-Sherbiny et al. (2014) reported that multiparity is an independent risk factor for anaemia in pregnancy ($\beta = 0.722$, $p = 0.02$, OR= 20.6 with 95% CI 1.12-3.8).

ii. Gravidity

Gravidity is defined as the number of pregnancy regardless of the pregnancy outcome (Cunningham, 2005). A study was done by Ali et al. (2019) revealed that multigravida women had higher risk to get anaemia as compared to primigravida women (AOR 1.19, 95% CI=0.32-4.44, $p < 0.001$). Similarly, in 2017, Lebso, Anato & Loha carried out a cross-sectional study involving 507 respondents. The overall prevalence of anaemia was 117

(23.2%), and this study reported that there was significant association between gravidity and anaemia. According to Mirzaie et al. (2010), multigravida women were two times more likely to get anaemia compared to primigravida women. The reason behind this is due to the number of pregnancy that increasing and physical changes during pregnancy that increases the susceptibility of getting repeated haemorrhage during delivery and maternal nutrition depletion. Also, the plasma volume during pregnancy is increased due to the hormonal changes, which causes a reduction of haemoglobin level.

iii. History of anaemia in a previous pregnancy

A cross-sectional study was conducted at the hospital Sidi Lahcen in the city of Temara, which involved 690 of pregnant women. This study showed that history anaemia in previous pregnancies (OR=3.33, 95% CI 1.99-5.5, $p < 0.001$) was associated with anaemia of pregnancy. Among 690 of pregnant women, 117 were found to be anaemic and 29.9% from 117 anaemic mothers were identified to have anaemia during previous pregnancy (Hasswane et al., 2015). Women who had anaemia in previous pregnancies tend to have persistent anaemia in the next pregnancy this is because most women have inadequate iron stores to start with when they embark upon a new pregnancy and when their iron stores become depleted at the end of their pregnancy, they often do not have time to replenish their stores (Fleming et al, 1974).

iv. Birth interval

It is recommended that the interval before attempting the next pregnancy is at least 24 months after a live birth to reduce the risk of adverse maternal, perinatal and infant outcomes (Conde-Agudelo et al., 2012). There were many studies done that revealed multiple unfavourable outcomes due to poor pregnancy spacing, one of it being anaemia during pregnancy. A cross-sectional survey conducted by Ali et al. (2019) used systemic random sampling in three hospitals of Unguja Island to select 388 pregnant women. In this study, 139 (41.12%) of pregnant women had birth interval of <2 years were more likely to have anaemia compared to respondents with birth interval of ≥ 2 years (AOR=3.84, 95% CI=1.10-11.88, $P<0.034$). Besides that, the risk of being anaemic was determined to be 2.2 (OR 2.22, 95% CI=0.55-8.95) times greater among women with poor inter-pregnancy interval, among 433 respondents that were involved in a cross-sectional study done in Azad Kashmir (Abbasi et al., 2013). Poor birth spacing contributes to many complications in pregnancy, therefore, the practice of it needs to be emphasized. A proper birth spacing alone could improve the outcomes of pregnancy.

v. Pre-pregnancy BMI

A study conducted by Lin et al. (2018) that involved 43,403 pregnant women reported that pre-pregnancy BMI $< 18.5 \text{ kg/m}^2$ was a predictor of anaemia, which may be due to the inadequate nutrition during pregnancy. Similarly, in a cross-sectional study on 363 pregnant women attending antenatal care clinic in Wolayita Soddo Otona Hospital reported underweight pre-pregnancy BMI were more likely to have anaemia due to the fact that anaemia is one of the most common nutritional deficiency disorders and it is common with underweight BMI (Gedefaw et al., 2015). The decline in maternal iron status throughout pregnancy was less severe among obese as compared to normal weight women (Jones et al., 2016).

2.3.3 Dietary Iron Intake

During pregnancy, women need to increase the amounts of protein intake in order to provide sufficient amino acids for fetal development, blood volume expansion, and growth of fetal and maternal tissues, such as the breast and uterus. Protein also contributes to the body's overall energy metabolism (London et al., 2008). A study conducted by El-Sherbiny et al. (2015) revealed that women with animal protein (meat, chicken and fish) intake at least once a week (OR 2.13, 95% CI=1.20-3.70) more at risk of developing anaemia during pregnancy. Similarly, a study done by Piammongkol et al. (2006) in Pattani, Thailand, a statistically significant association between meat intake and anaemia was distinguished ($p < 0.0001$). This study was conducted among 180 pregnant women between 32 to 40 weeks of gestation. Besides iron from animal sources, iron also can be found in non-animal sources such as the green leafy vegetables such as kale, spinach, and broccoli high in iron. In El-Sherbiny et al. (2015) studies, it showed that women with an intake of vegetables lesser than 4 servings daily at 3 (OR 3.10, 95% CI=1.99-4.84) times greater risk in developing iron deficiency anaemia.

2.3.4 Iron Supplementation

Iron supplementation is highly recommended for pregnant women. WHO recommended daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron is recommended for pregnant mothers to prevent maternal anaemia. A cross-sectional study was conducted on 284 pregnant women to assess prevalence and factors associated with anaemia at St. Paul's Hospital Millennium Medical College. The study reported that iron supplements were significantly associated with anaemia in which pregnant women who did not receive iron supplementation [AOR 4.03, 95% CI=1.49-10.92), and $P=0.01$] were more likely to be anaemic when compared to pregnant women who did take supplementations (Gebreweld et al., 2018). Similarly, in Lebso et al. (2017) study that conducted among the community at Lemo district, Southern Ethiopia. A total of 507 pregnant women were included in the study. It was revealed that iron not supplemented (AOR 1.72, 95% CI=1.02-2.91) showed statistically significant association ($p<0.05$) with anaemia.

CHAPTER 3

METHODOLOGY

3.1 Study Design

This was a cross-sectional study that examined the factors associated with haemoglobin level at third trimester of pregnancy among pregnant women attending antenatal care at Klinik Kesihatan Kajang, Selangor.

3.2 Study Location

The study was carried out in Klinik Kesihatan Kajang in Hulu Langat District, Selangor. Selangor is one of the 13 states of Malaysia and located on the west coast of Peninsular Malaysia. It is bordered by Perak to the north, Pahang to the east, Negeri Sembilan to the south and the Strait of Malacca to the west. There are nine districts in Selangor which include the Hulu Langat district. Based on the Department of Statistic Malaysia (2010), Hulu Langat District has about 1,156,585 populations which made Hulu Langat District is the second largest population in Selangor. There is a total of 12 governmental health clinics that provide antenatal care in Hulu Langat District which are Klinik Kesihatan Batu 9, Klinik Kesihatan

Batu 14, Klinik Kesihatan Kajang, Klinik Kesihatan Bandar Baru Bangi, Klinik Kesihatan Semenyih, Klinik Kesihatan Ampang, Klinik Kesihatan Beranang, Klinik Kesihatan Bandar Seri Putra, Klinik Kesihatan Sungai Chua, Klinik Kesihatan Balakong, Klinik Kesihatan Sungai Sekamat, and Klinik Kesihatan Bandar Tun Hussein Onn.

3.3 Sample Size

The estimated sample size was calculated using the formula by Margets and Nelson (1997) as shown below:

$$\text{Sample size, } n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{r^2 / (1-r^2)} + 5$$

Where,

α = Probability of making type I error, $\alpha = 0.05$. Thus, $Z_{1-\alpha/2} = 1.96$.

β = Probability of making type II error, $\beta = 0.05$, confidence level = 95%. Thus, $Z_{1-\beta} = 1.64$

r = The expected correlation coefficient

Table 3.1: Calculation of Sample Size

Correlation studies	Correlation, r	Sample size, N
Age with haemoglobin level (Khalid et al., 2017)	r = 0.345	$\text{Sample size, } n = \frac{(Z_{1-\alpha})^2 + Z_{1-\beta})^2}{r^2 / (1-r^2)} + 5$ $= \frac{(1.96 + 1.64)^2}{(0.345)^2 / (1-0.345^2)} + 5$ $= 101$
Parity with haemoglobin level (Khalid et al., 2017)	r = -0.344	$\text{Sample size, } n = \frac{(Z_{1-\alpha})^2 + Z_{1-\beta})^2}{r^2 / (1-r^2)} + 5$ $= \frac{(1.96 + 1.64)^2}{(-0.344)^2 / (1-(-0.344)^2)} + 5$ $= 102$
Meat intake with haemoglobin level (Khalid et al., 2017)	r = 0.300	$\text{Sample size, } n = \frac{(Z_{1-\alpha})^2 + Z_{1-\beta})^2}{r^2 / (1-r^2)} + 5$ $= \frac{(1.96 + 1.64)^2}{(0.300)^2 / (1-0.300^2)} + 5$ $= 136$
Oral supplementation with haemoglobin level (Khalid et al., 2017)	r = 0.322	$\text{Sample size, } n = \frac{(Z_{1-\alpha})^2 + Z_{1-\beta})^2}{r^2 / (1-r^2)} + 5$ $= \frac{(1.96 + 1.64)^2}{(0.322)^2 / (1-0.322^2)} + 5$ $= 117$

Table 3.1 showed the calculation of sample size. In this study, the sample size was determined using correlation, (r) between meat intake and haemoglobin level (r = 0.300) (Khalid et al., 2017). The calculated minimum size is 136 respondents. Additional 20% of respondents are added for recording error or incomplete data.

$$\begin{aligned} 20\% \text{ of the respondents} &= 136 \times 20\% \\ &= 27 \\ \text{Total respondents} &= 136 + 27 \\ &= 163 \end{aligned}$$

The total number of respondents required was 163 respondents.

3.4 Study Subjects

Respondents were selected based on the following criteria:

The inclusion criteria are:

- Pregnant women attending Maternal and Child Health Clinic at Hulu Langat, Selangor.
- Pregnant women who are Malaysians.
- Pregnant women who are 18 years old and above.

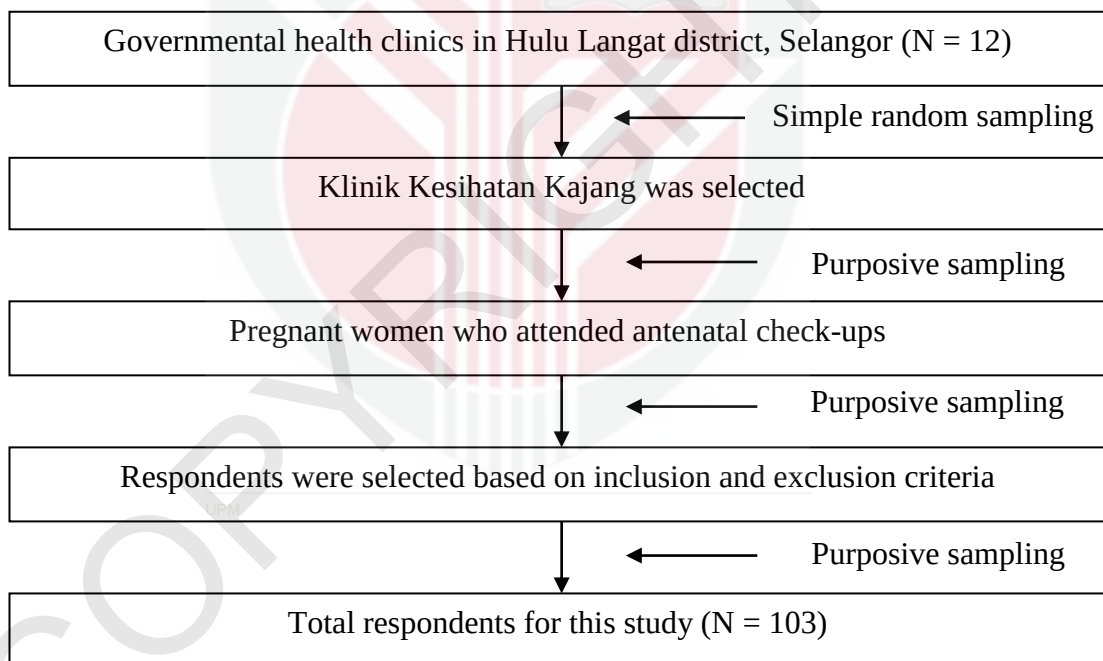
The exclusion criteria are:

- Pregnant women in the first and second trimester of pregnancy.
- Pregnant women with non-communicable diseases.

3.5 Sampling Design

Figure 3.1 shows the flow chart of sampling design of this study. There are 12 governmental health clinics in the Hulu Langat district. From these 12 clinics, Klinik Kesihatan Kajang was randomly selected in this study by using simple random sampling. Purposive sampling was then used in which all pregnant women who attended the prenatal check-up and met the inclusion and exclusion criteria were invited to participate in this study.

Figure 3.1: Flow Chart of Sampling Design



3.6 Measurements

Respondents were given self-administered questionnaire, which consists of questions related to respondent's demographic and socio-economic, dietary iron intake, and iron supplementation intake. Obstetric history and haemoglobin level at third trimester of respondents were taken from Maternal and Health Clinic (MHC) database system. This questionnaire was in Malay language and respondents were required to complete all the questions.

3.6.1 Demographic And Socio-Economic Factors

Demographic and socio-economic factors included date of birth, ethnicity, education level, employment status and monthly household income. Age was calculated based on the respondent's birth date.

3.6.2 Obstetric History

Obstetric history of the respondents was taken from the MCH database system that included parity, gravidity, history of anaemia in previous pregnancy, birth spacing and pre-pregnancy BMI. Gravidity is defined as number of pregnancy and parity is defined as the number of births after the 20th of gestation. Pre-pregnancy BMI was classified according to WHO cut-off points (WHO, 2004) as shown in Table 3.2.

<u>Classification</u>	<u>BMI (kg/m²)</u>
Underweight	<18.5
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	≥30.0

(WHO, 2004)

Table 3.2: Classification of pre-pregnancy BMI

3.6.3 Dietary Assessment

Dietary iron intake was assessed using a semi-quantitative food frequency questionnaire (SFFQ) adapted from the Malaysian Adult Nutrition Survey (MANS) (Norimah et al., 2008). It consisted of 69 food items that contain iron such as are meat and poultry, fish and seafood, eggs, nuts and its products, fruits and vegetables. Respondents were asked on the frequency and serving size of food intake over the previous 30 days. There were four options in the category for the frequency of intake, which were ‘per day’, ‘per week’, ‘per month’ and ‘never’. Respondents were required to answer frequency of intake for each food category by responding to the number of times in either one of the four options. The amounts and frequencies of food intakes recorded in the SFFQ were first converted to grams and then to nutrient intake. Nutrient intakes were estimated using the Nutrients

Composition of Malaysian Foods, and Atlas of Food Exchanges and Portion Sizes (Suzana et al., 2009; Tee et al., 1997). The amount of daily food intake was calculated from the SFFQ according to the following formula by Wessex Institute of Public Health Medicine (1995):

$$\text{Amount of food (g) per day} = \text{frequency of intake (conversion factor)} \times \text{serving size} \times \text{total number of serving} \times \text{weight of food in one serving}$$

Table 3.3: Formula to Calculate the Amount of Daily Food Intake

<u>Frequency of intake</u>	<u>Conversion factors</u>
Per day	1
Per week	1/7
Per month	1/30

(Norimah et al., 2008)

Table 3.4: Conversion Factor

Table 3.4 showed the conversion factor that was used to estimate food intake based on the frequency of intake. Data in grams was converted into calories and nutrients by using the Nutritionist Pro Software version 3.2.0. The amount of iron in food was the main content to measure dietary iron intake. The amount of daily intake by respondents was categorized based on the

American Pregnancy Association (APA) 2012. According to APA (2012), the recommendation for pregnant women to consume iron is 27mg daily.



3.6.4 Iron Supplementation

Self-administrated questionnaire was used to assess the respondent's iron supplementation intake. Questions included whether the respondent is on any iron supplementation, the type and brand of the supplementation, the frequency of intake (daily/weekly/monthly), and the dosage as well. The amount of iron content on each supplement was checked to determine whether the amount of iron intake from supplements was adequate according to the WHO recommendation. To prevent maternal anaemia, puerperal sepsis, low birth weight, and preterm birth, WHO (2012) recommend pregnant women to consume daily oral iron supplementation between 30 mg to 60 mg of elemental iron. The iron supplements taken by the respondents included ferrous fumarate, ferrous sulfate (obimin) and zincofer. One tablet of ferrous fumarate is equivalent to 66mg of elemental iron, one tablet of obimin is equivalent to 30mg of elemental iron, one tablet of zincofer is equivalent to 115 mg of elemental iron (WHO, 2012).

3.6.5 Haemoglobin Level

Haemoglobin concentration was tested using the haemoglobinometer analysis of the blood samples drawn from venous blood by the clinic nurses. Haemoglobinometer is a metering instrument used to measure the amount of haemoglobin (hb) in the blood. It is a reliable, acceptable, and accurate method (MOH Malaysia, 2007). Anaemia is considered severe when haemoglobin concentration is less than 7.0 g/dl, moderate when the haemoglobin concentration is 7.0 to 9.9 g/dl, and mild when haemoglobin concentration is 10.0 to 10.9 g/dl (WHO, 2011). Data of haemoglobin level at third trimester of pregnancy of pregnant women were obtained from the Maternal and Health Clinic (MHC) database system.

3.7 Pre-testing

Pre-testing of the questionnaire was conducted among 16 respondents, which was 10% of the estimated samples size. The purpose of this pre-testing was to determine the length of time required to complete the questionnaire and as well as to assess whether the questionnaire is easily understood by the respondents.

3.8 Data Collection

Data collection was conducted from September 2019 to March 2020. Respondents who met the study criteria and volunteered to participate were selected. Respondents were given self-administered questionnaire that included questions of demographic and socio-economic, dietary intake, and iron supplementation intake. Obstetric history and haemoglobin level at third trimester of pregnancy of respondents were obtained from the MHC database system. The questionnaire was collected after respondents completed the questionnaire for data analysis. The calculated sample size was 163 respondents. However, due to the Movement Control Order (MCO) that was implemented by the government on 18th March 2020, I was not able to continue my data collection at the clinic. Hence, I only managed to obtain 103 respondents which was more than 50% from my calculated sample size.

3.9 Data Analysis

Data were analysed using IBM SPSS for Windows version 22.0. Descriptive data was analysed using the univariate analysis. The results for categorical data was presented as frequencies and percentages, while continuous data was presented as mean and standard deviations, Chi-Square test was used to determine associations between two categorical variables. Fisher's Exact Test was used to determine the association between two categorical variables with low cell counts. A statistical level of $p < 0.05$ was considered as significant.

3.10 Ethics Approval

Ethics approval for this study was obtained from the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (KKM/NIHSEC/P18-2007(13)). An information sheet that consists of study description was given to the respondents prior to the administration of the questionnaire and they were required to sign on informed consent to take part in the study voluntarily.



CHAPTER 4

RESULTS AND DISCUSSION

This study was carried out to determine factors associated with haemoglobin level at third trimester of pregnancy among pregnant women attending antenatal care at Klinik Kesihatan Kajang, Selangor. A total of 123 questionnaires were distributed to the eligible respondents. The response rate was at 83.7% with a total of 103 completed questionnaires. About 16.2% of the respondents returned incomplete forms.

4.1 Characteristics of the Respondents

4.1.1 Demographic and Socio-economic Characteristics

Table 4.1 shows the demographic and socio-economic characteristics of the respondents. The mean age of the respondents from this study was 30.27 ± 4.95 years. Majority (69.0%) of the total respondents in this study were below 35 years old. The mean age of this study is similar with the previous study done by Celik et al. (2017) and Lebso et al. (2017), in which the mean age of their respondents was 30.00 ± 6.10 years and 28.70 ± 5.80 years respectively. The distribution of the ethnicity of the

respondents were Malays (87.4 %), followed by Indian (7.8%), Chinese (3.9%) and others (1.0%). This finding was expected as Malay mothers constituted majority of the pregnant women who came for their antenatal check-up (Soh et al., 2015). Most of the respondents were educated up to the level of tertiary education and 55.3% of the respondents were employed. This status of high employment rate among the respondents are consistent with the female's labour force participation rate which rose by 0.4 percentage points from 2018 reaching 55.6 per cent in 2019. (Department of Statistic Malaysia, 2020). Most of the respondents' (57.3%) household monthly income is in the range between RM2,300 – RM5,599. Similarly, a study done by Soh et al. (2015) reported that majority (63.0%) of the respondents had moderate household monthly incomes between RM1,500 to RM3,500. The finding from this study is being supported by the report of Household Income and Basic Amenities Survey 2016, by Department of Statistic Malaysia, in which the median household income for Malaysians is RM5,228.

Table 4.1: Demographic and socio-economic characteristics of the respondents (N=103)

Characteristics	Mean $\pm$ SD	n (%)
Age (Years)	30.27 $\pm$ 4.95	
<35 years		80 (77.7)
$\geq$ 35 years		23 (22.3)
Ethnicity		
Malay		90 (87.4)
Chinese		4 (3.9)
Indian		8 (7.8)
Others		1 (1.0)
Education level		
Primary		1 (1.0)
Secondary		33 (32.0)
Tertiary		69 (67.0)
Employment status		
Employed		57 (55.3)
Unemployed		46 (44.7)
Household monthly income level*	4135.92 $\pm$ 2275.40	
Low (<RM2,300)		24 (23.3)
Middle (RM2,300 – RM5,599)		78 (57.3)
High (RM5,600)		5 (19.4)

*Household monthly income level based on the 10th Malaysia Plan 2011-2015

4.1.2 Obstetrics characteristics

Table 4.2 shows the obstetric characteristics of the respondents. A total of 62 (60.2%) out of 103 respondents were multigravida and 41 (39.8%) were primigravida mothers. Most of the respondents are nulliparas (42.7%), followed by multipara (33.0%) and primipara (24.3%). The findings of this study were similar with Gebre1 & Mulugeta (2015) and Bekele et al. (2016) studies in which the percentage of nulliparous was higher than primiparous. As for the history of anaemia in previous pregnancy, 16.5% of the respondents had previous history of anaemia. Birth interval were categorised into two different categories which are spacing of less than 2 years (<2 years) and spacing of more than or equal to 2 years (≥ 2 years). Among the 62 multigravida respondents, 66.1% of them had birth interval of ≥ 2 year. The findings of this study were in line with Ndegwa et al. (2019) and Stephen et al. (2018) studies in which 94.4% and 89.4% of the respondents had birth interval of ≥ 2 years. However, it was contradicted with the study done by Lestari et al. (2018), in which majority of the respondents (63.6%) had birth interval of <2 years. The mean for pre-pregnancy BMI is 22.32 ± 4.04 . Majority of the respondents had normal BMI (60.2%), followed by overweight (21.4%), underweight (12.6%), and obese (5.8%). The findings of this study was in line with the study conducted by Vindhya et al. (2019), in which total number of respondents with normal BMI was the highest (54.29%). Similarly, in Lin et al. (2018) study, most of the respondents had normal BMI (67.3%), followed by underweight (15.5%), overweight (13.5%) and obese (3.7%).

Table 4.2: Obstetric characteristics of the respondents (N=103)

Characteristics	Mean $\pm$ SD	n (%)
Gravidity	2.49 $\pm$ 1.64	
Primigravida		41 (39.8)
Multigravida		62 (60.2)
Parity	1.22 $\pm$ 1.42	
Nullipara		44 (42.7)
Primipara		25 (24.3)
Multipara		34 (33.0)
History of anaemia in previous pregnancy		
Yes		17 (16.5)
No		86 (83.5)
Birth interval* (N=62)	1.50 $\pm$ 1.61	
<2 years		21 (33.9)
$\geq$ 2 years		41 (66.1)
Pre-pregnancy BMI (kg/m²)	22.32 $\pm$ 4.04	
Underweight		13 (12.6)
Normal		62 (60.2)
Overweight		22 (21.4)
Obese		6 (5.8)

*Not applicable for 41 respondents which are primidgravidas

4.1.3 Dietary iron intake

Table 4.3 shows the dietary iron intake of respondents. Iron in food comes from two sources which are animals and plants sources. In this study, the mean iron intake from animal sources was $8.90 \pm 9.14\text{mg}$ and plant sources was $8.32 \pm 7.84\text{mg}$. Meanwhile, the mean of total iron in the diet are of animal and plant sources was $18.23 \pm 14.96\text{mg}$ which is below the recommendation. Out of 103 respondents, 78.6% of them did not meet the recommendation. Similarly, with the study done by Cheng et al. (2010), the mean of total iron intake was 23.2.mg. In the study of Zhang et al. (2017), the intake of iron was observed to be significantly low, when compared to the recommendations. The finding of this study was supported by Liu et al. (2015) in which they found a significant iron deficiency among pregnant women in the third trimester of pregnancy, when the requirement of the foetus for iron is highest.

Table 4.3: Characteristics of dietary iron intake of respondents (N=103)

Characteristics	Mean $\pm$ SD	n (%)
Iron intake from animal sources	8.90 ± 9.14	
Iron intake from plant sources	8.32 ± 7.84	
Total iron intake	18.23 ± 14.96	
<27 mg/day		81 (78.6)
≥ 27 mg/day		22 (21.4)

4.1.4 Iron supplementation

Table 4.4 shows the iron supplement intakes of respondents. Among 103 respondents, 61.2% of the respondents took their iron supplements and consumed them on daily basis while 38.8% of the respondents did not consume any iron supplement on their current pregnancy. A similar result was revealed in the study by Zekarias et al. (2017) in which most their respondents (53.6%) took iron supplements during pregnancy. However, in contrast with study done by Bekele et al. (2016), majority of the respondents in this study did not consume any iron supplementation. Based on WHO recommendations, daily oral iron supplementation with 30mg to 60mg of elemental iron is recommended for pregnant women to prevent maternal anaemia. In this study, the mean elemental iron intake from supplements was 49.08 ± 47.75 mg. All of the respondents that took iron supplements met the WHO recommendation in which 23.8% met the elemental iron requirement in the range between 30mg and 60mg. Meanwhile, 76.2% consumed >60mg of elemental iron. This is because according to WHO (2012), if a woman is diagnosed with anaemia during pregnancy, her daily elemental iron should be increased to 120mg until her Hb concentration rises to normal. Thereafter, she can resume the standard daily antenatal iron dose to prevent recurrence of anaemia. The iron supplements taken by the respondents included ferrous fumarate, ferrous sulfate (obimin) and zincofer.

Table 4.4: Characteristics of Iron supplementations. (N=103)

Characteristics	Mean ± SD	n (%)
Intake of iron supplementation		
Yes		63 (61.2)
No		40 (38.8)
Frequency of intake (N=63)		
Daily		63 (100)
Dosage of intake* (N=63)		
	49.08 ± 47.75	
30mg – 60mg		15 (23.8)
>60mg		48 (76.2)

*Dosage of intake based on World Health Organization (2012) cut off points

4.1.5 Prevalence of Anaemia

Table 4.5 shows the anaemic status of the respondents and severity of anaemia. Among the 103 respondents, 28.2% of the respondents were anaemic during the period of this study. Meanwhile, most of the respondents (71.8%) are non-anaemic. This finding was similar with study done by Stephen et al. (2018) in which the percentage of non-anaemic respondents was higher than anaemic respondents. Among the anaemic respondents, 18.4% of the respondents had mild anaemia and followed by 9.7% of moderate anaemia. None of the respondents were having severe anaemia.

Table 4.5: Anaemic Status and Severity of Anaemia (N=103)

Characteristics	n (%)
Anaemic status	
Anaemia (Haemoglobin level < 11.0 g/dL)	29 (28.2)
Non-anaemia (Haemoglobin level $\geq$ 11.0 g/dL)	74 (71.8)
Severity of anaemia (N=29)	
Mild anaemia	19 (65.5)
Moderate anaemia	10 (34.5)
Severe anaemia	0 (0)

4.2 Factors Associated with Haemoglobin Level at Third Trimester of Pregnancy

4.2.1: Association between demographic and socio-economic factors and haemoglobin level

Table 4.6 shows the association between demographic and socio-economic factors and haemoglobin level at third trimester of pregnancy. Anaemia was more prevalent in the age group below 35 years old compared than in the age groups above 35 years old but there was no significant association was found between age and anaemia ($p>0.05$). Besides that, there was also no significant association between ethnicity and haemoglobin level. This probably due to the proportion of respondents were mainly Malay compared to the other ethnicity which might cause the result to be not significant (Soh et al., 2015). Education level of the pregnant women was significantly associated ($p=0.006$) with haemoglobin level. More than half of the anaemic mothers (55.2%) with secondary level of education. Similar finding was found in studies conducted Soh et al. (2015) and Suryanarayana et al. (2019) in which there was significant association between haemoglobin level and education level and majority of the anaemic respondents were with secondary education. According to Mariza (2016), anaemic pregnant women with low education have a higher prevalence than highly educated mothers. This is because mothers with higher education level are more concerned about their health and the health of their foetus, have more awareness about the dangers of anaemia hence they will maintain their Hb level in normal range, have better income and eat nutritious food (Soh et al., 2015; Stephen et al., 2018). Besides, with good education, they are more empowered to seek information, further knowledge as well as solutions for any health issues related

to them or their family. Furthermore, women with better education would have better employment which contributes to a better household income (Farrukh et al., 2016). The contribution of working mothers to their monthly household income could provide for more improved nutrition to the family and herself. However, in this study, there was no statistical significance for employment status ($p = 0.261$). Apart from that, the household monthly level was also not associated with haemoglobin level ($p=0.610$). The finding of this study was contradicted with study conducted by Bekele et al. (2016) in which monthly household income was significantly associated with anaemia in pregnancy. Bekele et al. (2016) reported that pregnant women with low income were at risk of anaemia because they could not get adequate nutrition and do not have the ability to buy quality and adequate quantity of food (Bekele et al., 2016). Higher income was less likely to develop anaemia during pregnancy (Xu et al., 2016).

Table 4.6: Association Between Demographic And Socioeconomic Factors And Haemoglobin Level At Third Trimester Of Pregnancy (N=103)

Variables	Anaemic (Haemoglobin level < 11.0 g/dL)	Non-anaemic (Haemoglobin level ≥ 11.0 g/dL)	X ²	p- value
	n (%)	n(%)		
Age (Years)				
<35 years	21 (72.4)	59 (79.7)	0.290	0.590
≥35 years	8 (27.6)	15 (20.3)		
Ethnicity				
Malay	19 (65.5)	71 (95.9)	€	0.150
Chinese	2 (6.9)	2 (2.7)		
Indian	8 (27.6)	0 (0)		
Others	0 (0)	1 (1.4)		
Education Level				
Primary	1 (3.4)	2 (2.7)	9.235	0.006*
Secondary	16 (55.2)	18 (24.3)		
Tertiary	12 (41.4)	54 (73.0)		
Employment status				
Employed	13 (44.8)	44 (59.5)	1.261	0.261
unemployed	16 (55.2)	30 (40.5)		
Household monthly level				
Low (<RM2,300)	8 (27.6)	16 (32.6)	0.988	0.610
Middle (RM2,3000 – RM5,599)	17 (58.6)	42 (56.8)		
High (RM5,600)	4 (13.8)	16 (21.6)		
€ (Fisher’s Exact Test)				

*Association is significant at p<0.05

4.2.2: Association between obstetric history and haemoglobin level

Table 4.7 shows the association between obstetric history and haemoglobin level at third trimester of pregnancy. Among all the variables listed below, history of anaemia in previous pregnancy and pre-pregnancy BMI were found to be associated with haemoglobin level at third trimester of pregnancy. There were no significant associations between gravidity, parity, birth interval and haemoglobin level at third trimester of pregnancy. Parity and gravidity did not have a significant association with haemoglobin level. The finding was in contrast with Lestari et al. (2018) study in which parity was significantly associated with anaemia where women with parity more than two times were more likely to have anaemia than mothers with parity less than two. Similarly, in 2017, Lebso, Anato & Loha revealed that multigravida was found to be significantly associated with anaemia. This is due to increase in number of pregnancy and physical changes during pregnancy increase the susceptibility of getting repeated haemorrhage during delivery and maternal nutrition depletion. History of anaemia in previous pregnancy was found to be significantly associated ($p=0.001$) with haemoglobin level at third trimester of pregnancy. This finding of this study was in line with study conducted by Hasswane et al. (2015) that pregnant women with history of anaemia in previous pregnancy were more prone to develop anaemia in the current pregnancy. This is mainly because most women have inadequate iron stores to start with when they embark upon a new pregnancy and when their iron stores become depleted at the end of their pregnancy, they often do not have time to replenish their stores (Loy et al., 2019). Besides that, this study found no significant association between birth interval and haemoglobin level at third trimester of pregnancy. However, other studies reported pregnant women that had birth interval of <2 years were more likely to have anaemia due to decreased iron

store of women due to occurrence of pregnancy in quick succession between subsequent pregnancies and poor healing time for the mother that prevents the normalization of her haemoglobin level before the next pregnancy (Ali et al., 2019; Bekele et al., 2016). This study found significant association between pre-pregnancy BMI and haemoglobin level at third trimester of pregnancy. Anaemia was more prevalent in normal pre-pregnancy BMI followed by underweight and overweight/obese. This finding was contradicted with study conducted by Lin et al. (2018) and Gedefaw et al. (2015) in which underweight pre-pregnancy BMI < 18.5 kg/ m² were more likely to have anaemia due to the fact that anaemia is one of the most common nutritional deficiency disorders and it is common with underweight BMI. In this study, the reason why the prevalence of anaemia was high in normal pre-pregnancy BMI compared to other studies probably due to the difference in lifestyle and eating habit of the respondents. Even they had a normal BMI, it does not mean they are not deficient in certain micronutrients especially iron. According to Vindhya et al. (2019), the link between BMI and anaemia could not be identified even though pregnant women with a lower BMI were more likely to be anaemic.

Table 4.7: Association Between Obstetric History And Haemoglobin Level At Third Trimester Of Pregnancy (N=103)

Variables	Anaemic (Haemoglobin level < 11.0 g/dL)	Non-anaemic (Haemoglobin level ≥ 11.0 g/dL)	X ²	p- value
	n (%)	n(%)		
Gravidity				
Primigravida	10 (34.5)	31 (41.9)	0.218	0.640
Multigravida	19 (65.5)	43 (58.1)		
Parity				
Nullipara	12 (41.4)	33 (44.6)	3.323	0.190
Primipara	4 (13.8)	20 (27.0)		
Multipara	13 (44.8)	21 (28.4)		
History of anaemia in previous pregnancy				
Yes	11 (37.9)	6 (8.1)	€	0.001*
No	18 (62.1)	68 (91.9)		
Birth interval**(N=62)				
<2 years	6 (20.7)	15 (20.3)	1.509	0.470
≥2 years	14 (48.3)	27 (36.5)		
Pre-pregnancy BMI				
Underweight	6 (20.7)	7 (9.5)	10.030	0.006*
Normal	21 (72.4)	41 (55.4)		
Overweight/obese	2 (6.9)	26 (35.1)		

€ (Fisher's Exact Test)

*Association is significant at $p < 0.05$

**Not applicable for 41 respondents which are primidgravidas

4.2.3: Association between dietary iron intake and haemoglobin level

Table 4.8 illustrates the associations between dietary iron intake and haemoglobin level at third trimester of pregnancy. Iron intake was not significantly associated with haemoglobin level ($\chi^2 = 0.142$, $p = 0.707$). Out of 29 anaemic respondents, 72.4% of them had low dietary iron intake and did not meet the recommendation which is 27mg of iron daily. The finding of this study was supported by previous study conducted by Suryanarayana et al. (2019) in which the high prevalence of anaemia can be attributed to low dietary intake of iron. Similarly, in Gebreweld & Tsegaye (2018) study, the prevalence of anaemia was also higher in those pregnant women who had low consumption of iron intake due to a habit of eating less meat and animal products (16.7%) and less fruits and vegetables (33.3%).

Table 4.8: Association Between Dietary Iron Intake And Haemoglobin Level At Third Trimester Of Pregnancy (N=103)

Variables	Anaemic (Haemoglobin level < 11.0 g/dL) n (%)	Non-anaemic (Haemoglobin level $\geq$ 11.0 g/dL) n(%)	χ^2	P- value
Total iron intake				
<27 mg/day	21 (72.4)	60 (81.1)	0.487	0.485
$\geq$ 27 mg/day	8(27.6)	14 (18.9)		

4.2.4: Association between iron supplement and haemoglobin level

Table 4.9 shows the association between iron supplement and haemoglobin level at third trimester of pregnancy. This study found no significant association between iron supplement and haemoglobin level at third trimester of pregnancy. However, the prevalent of anaemic respondents were higher in those who did not take iron supplement. This finding is in line with study done by Gebre & Mulugeta (2015) in which the prevalence of anaemia was significantly higher among pregnant women who did not take iron supplementation during pregnancy as compared to those pregnant women who took their iron supplementation. Pregnant women who did not take iron supplementation were at 3.76 times higher risk to be anaemic as compared to pregnant women who took their iron supplementation (Ali et al., 2019). This could be due to increased iron requirements to supply the expanding blood volume of the mother and the rapidly growing fetus and placenta (Lestari et al., 2018). The blood volume of pregnant woman decreases by 50% during this period as a result, supplementation of iron during pregnancy is critical to fulfil this requirement (Bekele et al., 2016). In contrast with studies done by Gebreweld et al. (2018) and Lebso et al. (2017), iron supplementation was found to be significantly associated ($p<0.05$) with haemoglobin level. Besides that, the frequency of intake was also not significantly associated with haemoglobin level. This probably because 100% of the respondents that consumed iron supplements took it in a daily basis. According to Tulu et al. (2019), pregnant women who took iron supplements irregularly were almost 3 times more likely to be anaemic. Apart from that, dosage intake was also not significantly associated with haemoglobin level. This could be due to the fact that all of the respondents that took iron supplements met the WHO recommendation for elemental iron intake during pregnancy. Lack of iron supplementation is amongst the

most significant risk factors for developing anaemia in pregnant women (Lestari et al., 2018).

Table 4.9: Association Between Iron Supplement And Haemoglobin Level At Third Trimester Of Pregnancy (N=103)

Variables	Anaemic (Haemoglobin level < 11.0 g/dL)	Non-anaemic (Haemoglobin level ≥ 11.0 g/dL)	X ²	P-value
	n (%)	n(%)		
Intake of iron supplementation				
Yes	14 (48.3)	49 (66.2)	0.478	0.489
No	15 (51.7)	25 (33.8)		
Frequency of intake				
Daily	14 (48.3)	49 (66.2)	2.118	0.146
Dosage (elemental iron intake)				
30mg – 60mg	2 (14.3)	13 (26.5)	€	0.486
>60mg	12 (85.7)	36 (73.5)		
€ (Fisher’s Exact Test)				

CHAPTER 5

CONCLUSION, LIMITATION AND RECOMMENDATION

5.1 Conclusion

The findings of this study revealed that the majority of the pregnant mother involved in this study were non-anaemic (71.8%). Those that were anaemic (28.2%) were mostly those with mild anaemia (65.5%), followed by moderate anaemia (34.5%). None of the respondents had severe anaemia. Factors that were significantly associated with haemoglobin level at the third trimester of pregnancy were education level ($p=0.006$), history of anaemia in previous pregnancy ($p<0.001$), and pre-pregnancy BMI ($p=0.006$). It is important to target these 3 factors to come out with an intervention. Women who had low education and lack of knowledge related to healthy pregnancy may develop anaemia during their first pregnancy. Hence, having history of anaemia in previous pregnancy increases the risk of the mother to develop anaemia for her next pregnancy. Besides that, lack of knowledge on the importance of consuming adequate nutrition for healthy body weight for pregnancy also increases the risk to develop anaemia in pregnancy. Health education on reproductive health, early diagnosis of high-risk pregnancy, and appropriate management and

strengthening of their healthcare-seeking behavior are important health-care measures to be undertaken at the community level.

Factors that were not significantly associated with haemoglobin level at third trimester of pregnancy were age, ethnicity, employment status, household monthly income level, gravidity, parity, birth interval, dietary iron intake and iron supplementation.



5.2 Limitations

As this is a cross sectional study, which can only study the relationship and association between independent variables and dependent variable. The temporal relationship of causation and dependent variable cannot be determined as this was only study done at the point of time. Findings cannot be generalized to all pregnant women in Malaysia as it was only involved pregnant women in Maternal and Health Clinic Kajang. Further limitation for this study was the self-reported questionnaire in which it was highly dependent on willingness, honesty, sincerity of the respondents and ability to understand the questions well.

5.3 Recommendation

There are a few recommendations for future studies regarding on this topic. Firstly, include pregnant women from other clinics so that findings can be generalized to all pregnant women in Malaysia. Secondly, a different study design should be considered in the future. For instance, a cohort study would give a temporal relationship between the independent variables and the dependent variable. Similarly, a case-control study may also contribute to further explore the associated factors as well as the predictors for anaemia in pregnancy. Apart from that, other factors such as marital status, history of abortion, depression and tea consumption in relation to anaemia in pregnancy should be included in the future study. Lastly, intervention or health promotion programs among pregnant women should be conducted that emphasize the importance of healthy eating, healthy weight management and oral supplementation.

REFERENCES

- Abbasi, A., Arooj, S., Hussain, W., Mughal, A. I., Habib, N., Aziz, W., & Rafique, M. (2013). Causes of anemia in pregnant women of the state of azad kashmir: A cross-sectional survey.
- Abbaspour, N., Hurrell, R., & Kelishadi, R. (2014). Review on iron and its importance for human health. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences*, 19(2), 164.
- Abrams, S. A. (2005). Calcium supplementation during childhood: long-term effects on bone mineralization. *Nutrition reviews*, 63(7), 251-255.
- Ali, M. M., Ngowi, A. F., & Gibore, N. S. (2019). Prevalence and obstetric factors associated with anaemia among pregnant women, attending antenatal care in Unguja island, Tanzania. *International Journal Of Community Medicine And Public Health*, 6(3), 950-957.
- Alemu, T., & Umeta, M. (2015). Reproductive and obstetric factors are key predictors of maternal anemia during pregnancy in Ethiopia: evidence from demographic and health survey (2011). *Anemia*, 2015.
- Ahenkorah, B., Nsiah, K., & Baffoe, P. (2016). Sociodemographic and obstetric characteristics of anaemic pregnant women attending antenatal clinic in Bolgatanga Regional Hospital. *Scientifica*, 2016.
- Asrie, F. (2017). Prevalence of anemia and its associated factors among pregnant women receiving antenatal care at Aymiba Health Center, northwest Ethiopia. *Journal of blood medicine*, 8, 35.
- Bekele, A., Tilahun, M., & Mekuria, A. (2016). Prevalence of anemia and Its associated factors among pregnant women attending antenatal care in health institutions of Arba Minch town, Gamo Gofa Zone, Ethiopia: A Cross-sectional study. *Anemia*, 2016.
- Biswas, M., & Baruah, R. (2020). Maternal anaemia and pregnancy outcome: a descriptive study in rural areas of Kamrup District, Assam. *Int J Pregn & Chi Birth*. 2020;6(3):55–58. DOI: 10.15406/ipcb.2020.06.00197
- Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., ... & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The lancet*, 382(9890), 427-451.
- Conde-Agudelo, Agustín & Rosas-Bermudez, Anyeli & Castano, Fabio & Norton, Maureen. (2012). Effects of Birth Spacing on Maternal, Perinatal, Infant, and Child Health: A Systematic Review of Causal Mechanisms. *Studies in family planning*. 43. 93-114. 10.2307/23409232.

Cox, S., Hoffman, B., Werner, C., & Cunningham, F. (2005). *Williams Obstetrics 22nd Edition Study Guide*. McGraw-Hill Professional.

Cunningham, Gary (2005). *William Obstetrics* (PDF) (22 ed.). McGraw-Hill Companies. p. 121. ISBN 978-0-07-141315-2.

Chowdhury, H. A., Ahmed, K. R., Jebunessa, F., Akter, J., Hossain, S., & Shahjahan, M. (2015). Factors associated with maternal anaemia among pregnant women in Dhaka city. *BMC women's health*, 15(1), 77.

Department of Statistics Malaysia. (2010). Population distribution and basic demographic characteristic report 2010. *Population and Housing Census*.

Department of Statistics Malaysia. (2017). Report of household income and basic amenities survey 2016.

Department of Statistics Malaysia (2020). Press Release Labour Force Survey Report, Malaysia, 2019.

Di Renzo, G. C., Spano, F., Giardina, I., Brillo, E., Clerici, G., & Roura, L. C. (2015). Iron deficiency anemia in pregnancy. *Women's Health*, 11(6), 891-900.

El-Sherbiny, N. A., Masoud, M., Shalaby, N. M., & Shehata, H. S. (2015). Prevalence and Determinants of Anaemia in Third Pregnancy in Fayoum Governorate, Egypt. *Acta Medica Mediterranea*, 2014, 30: 1045

Fatihah, F., Ng, B. K., Hazwanie, H., Norimah, A. K., Shanita, S. N., Ruzita, A. T., & Poh, B. K. (2015). Development and validation of a food frequency questionnaire for dietary intake assessment among multi-ethnic primary school-aged children. *Singapore medical journal*, 56(12), 687–694. doi:10.11622/smedj.2015190

Fleming AF, Martin JD & Stenhouse NS (1974): Obstetric outcome in pregnancies complicated by recurrent anaemia, with observations on iron and folate metabolism, bacteriuria and preeclampsia. *Aust. N. Z. J.Obstt. Gynaecol.* 14, 204.

Gebreweld, A., & Tsegaye, A. (2018). Prevalence and factors associated with anemia among pregnant women attending antenatal clinic at St. Paul's hospital millennium medical college, Addis Ababa, Ethiopia. *Advances in hematology*, 2018.

Grace Stephen, Melina Mgongo, Tamara Hussein Hashim, Johnson Katanga, Babill Stray-Pedersen, and Sia Emmanuelli Msuya, "Anaemia in Pregnancy: Prevalence, Risk Factors, and Adverse Perinatal Outcomes in Northern Tanzania," *Anemia*, vol. 2018, Article ID 1846280, 9 pages, 2018. <https://doi.org/10.1155/2018/1846280>.

- Gebre, A., & Mulugeta, A. (2015). Prevalence of anemia and associated factors among pregnant women in North Western zone of Tigray, Northern Ethiopia: a cross-sectional study. *Journal of nutrition and metabolism*, 2015.
- Gedefaw, L., Ayele, A., Asres, Y., & Mossie, A. (2015). Anaemia and associated factors among pregnant women attending antenatal care clinic in Walayita Sodo town, Southern Ethiopia. *Ethiopian journal of health sciences*, 25(2), 155-164.
- Getachew, M., Yewhalaw, D., Tafess, K., Getachew, Y., & Zeynudin, A. (2012). Anaemia and associated risk factors among pregnant women in Gilgel Gibe dam area, Southwest Ethiopia. *Parasites & vectors*, 5(1), 296.
- Goh, T. H., & Hariharan, M. (1986). Iron-deficiency anaemia and serum ferritin levels in Malaysian women. *Medical Journal of Malaysia*, 41, 300-304.
- Grum, T., Brhane, E., Hintsa, S., & Kahsay, G. (2018). Magnitude and factors associated with anemia among pregnant women attending antenatal care in public health centers in central zone of Tigray region, northern Ethiopia: a cross sectional study. *BMC pregnancy and childbirth*, 18(1), 1-7.
- Gupta, C. P. (2014). Role of iron (Fe) in body. *IOSR Journal of Applied Chemistry*, 7(11), 38-46.
- Harvey, T., Zkik, A., Auges, M., & Clavel, T. (2016). Assessment of iron deficiency and anemia in pregnant women: an observational French study. *Women's Health*, 12(1), 95-102.
- Hasswane, N., Bouziane, A., Mrabet, M., Laamiri, F. Z., Aguenau, H., & Barkat, A. (2015). Prevalence and factors associated with anemia pregnancy in a group of Moroccan pregnant women. *Journal of Biosciences and Medicines*, 3(10), 88.
- Institute for Public Health (IPH), National Institutes of Health, Ministry of Health Malaysia. 2016. National Health and Morbidity Survey (NHMS) 2016: Maternal and Child Health. Vol. II: Findings, 2016. pp 272
- Jamaiyah Haniff, M. P. H., Anita Das, M. P. H., Onn, L. T., MRCOG, N. M. N., Sanjay Rampal, M. P. H., Safiah Bahrin, M. P. H., ... & Zaher, Z. M. M. (2007). Anemia in pregnancy in Malaysia: a cross-sectional survey. *Asia Pacific Journal of Clinical Nutrition*, 16(3), 527.
- Jansen, V. (2019). Diagnosis of anemia—A synoptic overview and practical approach. *Transfusion and Apheresis Science*, 58(4), 375-385.
- Jones, A. D., Zhao, G., Jiang, Y. P., Zhou, M., Xu, G., Kaciroti, N., ... & Lozoff, B. (2016). Maternal obesity during pregnancy is negatively associated with maternal and neonatal iron status. *European journal of clinical nutrition*, 70(8), 918-924.

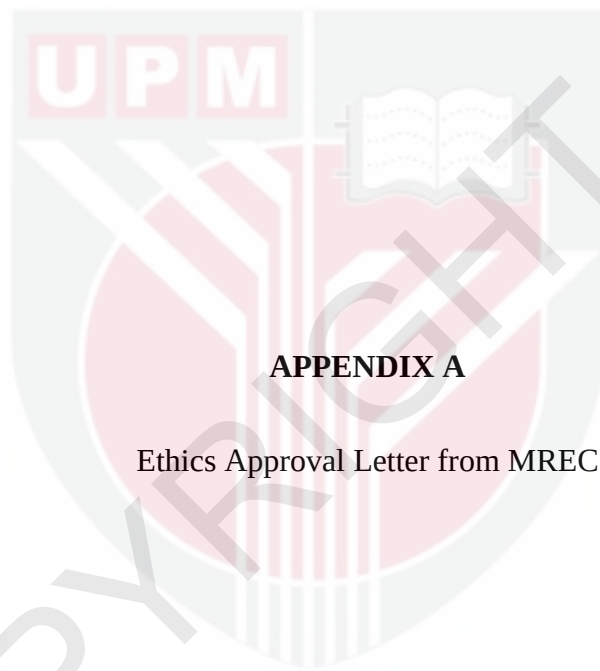
- Karaoglu, L., Pehlivan, E., Egri, M., Deprem, C., Gunes, G., Genc, M. F., & Temel, I. (2010). The prevalence of nutritional anemia in pregnancy in an east Anatolian province, Turkey. *BMC public health*, 10(1), 1-12.
- Kavak, E. Ç., & Kavak, S. B. (2017). The association between anemia prevalence, maternal age and parity in term pregnancies in our city. *Perinatal Journal*, 25(1), 6-10.
- Khalid, R., Irshad, J., Saleem, A., & Ashraf, S. (2017). Risk factors for Anemia in Pregnant Women in a rural area of Bahawalnagar Pakistan-a Descriptive Cross Sectional Study. *PAKISTAN JOURNAL OF MEDICAL & HEALTH SCIENCES*, 11(4), 1238-1242.
- Lebso M, Anato A, Loha E (2017) Prevalence of anemia and associated factors among pregnant women in Southern Ethiopia: A community based cross-sectional study. *PLoS ONE* 12(12): e0188783. <https://doi.org/10.1371/journal.pone.0188783>
- Lestari, S., Fujiati, I. I., Keumalasari, D., Daulay, M., Martina, S. J., & Syarifah, S. (2018). The prevalence of anemia in pregnant women and its associated risk factors in North Sumatera, Indonesia. In *IOP Conference Series: Earth and Environmental Science* (Vol. 125, No. 1, p. 012195). IOP Publishing.
- Lin, L., Wei, Y., Zhu, W., Wang, C., Su, R., Feng, H., & Yang, H. (2018). Prevalence, risk factors and associated adverse pregnancy outcomes of anaemia in Chinese pregnant women: a multicentre retrospective study. *BMC pregnancy and childbirth*, 18(1), 111.
- Liu, T., Zhong, S., Liu, L., Liu, S., Li, X., Zhou, T., & Zhang, J. (2015). Vitamin D deficiency and the risk of anemia: a meta-analysis of observational studies. *Renal Failure*, 37(6), 929-934.
- London, M., Davidson, M. R., & Wieland, P. A. (2008). *Olds' maternal-newborn nursing & women's health across the lifespan*. Upper Saddle River, NJ: Pearson Education, Inc.
- Loy, S.L., Marhazlina M, Nor AY, and Hamid J.J. (2011) . Development, validity and reproducibility of a food frequency questionnaire in pregnancy for the Universiti Sains Malaysia birth cohort study. *Malays J Nutr* 2011;17:1-18.
- Loy, S. L., Lim, L. M., Chan, S. Y., Tan, P. T., Chee, Y. L., Quah, P. L., & Shek, L. P. C. (2019). Iron status and risk factors of iron deficiency among pregnant women in Singapore: a cross-sectional study. *BMC public health*, 19(1), 397.
- Margetts, B. M., & Nelson, M. (Eds.). (1997). *Design concepts in nutritional epidemiology*. OUP Oxford.

- Mariza, A. (2016). Hubungan pendidikan dan sosial ekonomi dengan kejadian anemia pada ibu hamil di BPS T Yohan Way Halim Bandar Lampung tahun 2015. *Holistik Jurnal Kesehatan*, 10(1), 5-8.
- Mbule MA, Byaruhanga YB, Kabahenda M, Lubowa A, Mbule M: Determinants of anaemia among pregnant women in rural Uganda. *Rural Remote Health*. 2013, 13 (2259): 15-49.
- McLean, E., Cogswell, M., Egli, I., Wojdyla, D., & De Benoist, B. (2009). Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993–2005. *Public health nutrition*, 12(4), 444-454.
- Mekonnen, F. A., Ambaw, Y. A., & Neri, G. T. (2018). Socio-economic determinants of anemia in pregnancy in North Shoa Zone, Ethiopia. *PloS one*, 13(8), e0202734.
- Milman N (2015) Iron Deficiency and Anaemia in Pregnant Women in Malaysia – Still a Significant and Challenging Health Problem. *J Preg Child Health* 2:168. doi:10.4172/2376-127X.1000168
- Milman, N. T. (2019). Dietary Iron Intake in Women of Reproductive Age in Europe: A Review of 49 Studies from 29 Countries in the Period 1993–2015. *Journal of nutrition and metabolism*, 2019.
- Ministry of Health Malaysia. Malaysian Adult Nutrition Survey 2003. Putrajaya: Nutrition Section Family Health Development Division Ministry of Health Malaysia; 2007.
- Mirzaei, F., Eftekhari, N., Goldouzian, S., & Mahdavinia, J. (2010). Prevalence of anemia risk factors in pregnant women in Kerman, Iran.
- NCCFN (National Coordinating Committee on Food and Nutrition). (2017). Recommended nutrient intakes for Malaysia (RNI): A report of the Technical Working Group on Nutritional Guidelines.
- Ndegwa, S. K. (2019). Anemia & its associated factors among pregnant women attending antenatal clinic at Mbagathi County Hospital, Nairobi County, Kenya. *African Journal of Health Sciences*, 32(1), 59-73.
- Norimah, A. K. (2012). Development and validation of a Food Frequency Questionnaire (FFQ) for assessing sugar consumption among adults in Klang Valley, Malaysia. *Malaysian journal of nutrition*, 18(3).
- Norimah AK, Safiah M, Jamal K, Haslinda S, Zuhaida H, Rohida S, Fatimah S, Norazlin S, Poh BK, Kandiah M, Zalilah MS, Wan Manan WM, Fatimah S, Azmi MY. Food consumption patterns: findings from the Malaysian adult nutrition survey (MANS). *Malays J Nutr* 2008;14:25-39.

- Noviyanti, B., Simanjuntak, H. C., Hutasoit, E. S. P., Silitonga, H. A., & Julianto, E. (2019). The Relationship between social economic levels and anemia events in pregnant women in Glugur Darat Health Center. *Journal of Maternal and Child Health*, 4(6), 440-447.
- Prime Minister's Department, The Economic Planning Unit (MY). Tenth Malaysia Plan 2011-2015. Putrajaya: Prime Minister's Department, The Economic Planning Unit; 2010.
- Piammongkol, S., Chongsuvivatwong, V., Williams, G., & Pornpatkul, M. (2006). The prevalence and determinants of iron deficiency anemia in rural Thai-Muslim pregnant women in Pattani Province. *Southeast Asian journal of tropical medicine and public health*, 37(3), 553.
- Salhan, S., Tripathi, V., Singh, R., & Gaikwad, H. S. (2012). Evaluation of hematological parameters in partial exchange and packed cell transfusion in treatment of severe anemia in pregnancy. *Anemia*, 2012.
- Siddiqui, M. Z., Goli, S., Reja, T., Doshi, R., Chakravorty, S., Tiwari, C., ... & Singh, D. (2017). Prevalence of anemia and its determinants among pregnant, lactating, and nonpregnant nonlactating women in India. *SAGE Open*, 7(3), 2158244017725555.
- Singal, N., Setia, G., Taneja, B. K., & Singal, K. K. (2018). Factors associated with maternal anaemia among pregnant women in rural India. *Bangladesh Journal of Medical Science*, 17(4), 583-592. <https://doi.org/10.3329/bjms.v17i4.38320>
- Siong, T. E., ASEAN, K. L. M., Noor, M. I., Azudin, M. N., & Idris, K. (1988). Nutrient composition of Malaysian foods.
- Sholeye, O. O., Animasahun, V. J., & Shorunmu, T. O. (2017). Anemia in pregnancy and its associated factors among primary care clients in Sagamu, Southwest, Nigeria: A facility-based study. *Journal of family medicine and primary care*, 6(2), 323.
- Soh, K.L., Tohit, E.R.M., Japar, S., Geok, S.K., Ab Rahman, N.B. and Raman, R.A. (2015) Anemia among Antenatal Mother in Urban Malaysia. *Journal of Biosciences and Medicines*, 3, 6-11.
- Stephen, G., Mgongo, M., Hussein Hashim, T., Katanga, J., Stray-Pedersen, B., & Msuya, S.E. (2018). Anaemia in pregnancy: Prevalence, risk factors, and adverse perinatal outcomes in Northern Tanzania. *Anemia*, 2018.
- Suryanarayana, R., Chandrappa, M., Santhuram, A. N., Prathima, S., & Sheela, S. R. (2017). Prospective study on prevalence of anemia of pregnant women and its outcome: A community based study. *Journal of family medicine and primary care*, 6(4), 739.

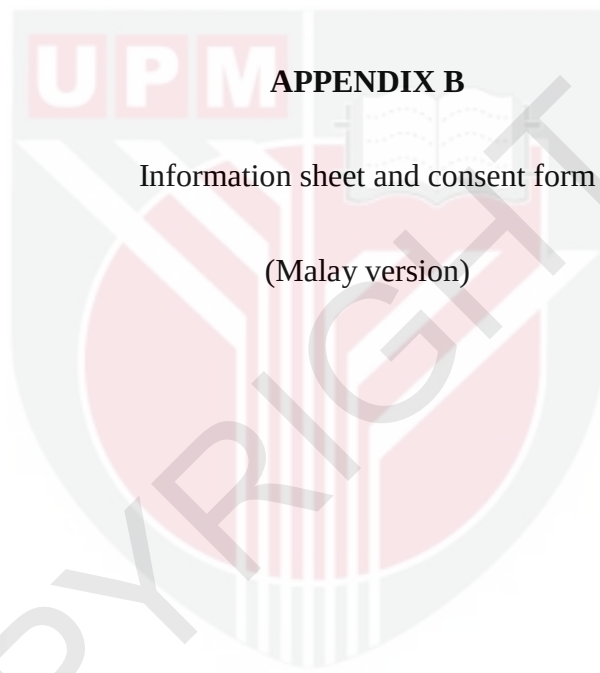
- Suzana, S., Rafidah, G., Noor Aini, M. Y., Nik Shanita, S., Zahara, A. M., & Shahrul Azman, M. N. (2009). *Atlas of food exchanges and portion sizes. Kuala Lumpur: MDC Publishers.*
- Symington, E. A., Baumgartner, J., Malan, L., Wise, A. J., Ricci, C., Zandberg, L., & Smuts, C. M. (2019). Maternal iron-deficiency is associated with premature birth and higher birth weight despite routine antenatal iron supplementation in an urban South African setting: The NuPED prospective study. *PloS one*, 14(9), e0221299.
- Tee ES, Ismail MN, Nasir MA & Khadijah I (1997): Nutrient Composition of Malaysian Foods, Malaysian Food Composition Database Programme, 4th edn. Kuala Lumpur, Malaysia: Institute for Medical Research.
- Tulu BD, Atomssa EM, Mengist HM (2019). Determinants of anemia among pregnant women attending antenatal care in Horo Guduru Wollega Zone, West Ethiopia: Unmatched casecontrol study. *PLoS ONE* 14(10): e0224514. <https://doi.org/10.1371/journal.pone.0224514>
- Vindhya J, Nath A, Murthy GV, Metgud C, Sheeba B, Shubhashree V, et al. (2019). Prevalence and risk factors of anemia among pregnant women attending a public-sector hospital in Bangalore, South India. *J Family Med Prim Care* 2019;8:37-43.
- Wessex Institute of Public Health Medicine(1995). University of Southampton.
- Williamson, C. S. (2006). Nutrition in pregnancy. *Nutrition bulletin*, 31(1), 28-59.
- World Health Organization. (2001). Iron deficiency anemia. assessment, prevention, and control. *A guide for programme managers*, 47-62.
- World Health Organization. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet (London, England)*, 363(9403), 157.
- World Health Organization. (2008). Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia.
- World Health Organization. (2010). *World health statistics 2010*. World Health Organization.
- World Health Organization. (2011). *Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity* (No. WHO/NMH/NHD/MNM/11.1). World Health Organization.
- World Health Organization (WHO). 2012. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Geneva: World Health Organization; 1-6.

- World Health Organization. (2012). *Guideline: Daily iron and folic acid supplementation in pregnant women*. World Health Organization.
- World Health Organization. (2016). *World health statistics 2016: monitoring health for the SDGs sustainable development goals*. World Health Organization.
- Wright, S., Earland, D., Sakhuja, S., Junkins, A., Franklin, S., Padilla, L., ... & Jolly, P. E. (2017). Anemia in pregnancy in Western Jamaica. *International Journal of Women's Health*, 9, 431.
- Xu, X., Liu, S., Rao, Y., Shi, Z., Wang, L., Sharma, M., & Zhao, Y. (2016). Prevalence and sociodemographic and lifestyle determinants of anemia during pregnancy: a cross-sectional study of pregnant women in China. *International journal of environmental research and public health*, 13(9), 908.
- Yaghoobi, H., Zolfizadeh, F., Asadollahi, Z., Vazirinejad, R., & Rezaeian, M. (2015). Prevalence of iron deficiency anemia and some related factors among pregnant women referred to healthcare centers in Bandar Lengeh, Iran, in 2015. *Journal of Occupational Health and Epidemiology*, 4(2), 92-100.
- Zekarias B, Meleko A, Hayder A, Nigatu A, Yetagessu T (2017) Prevalence of anemia and its Associated Factors among Pregnant Women Attending Antenatal Care (ANC) In Mizan-Tepi University Teaching Hospital, South West Ethiopia. *Health Sci J*. Vol. 11 No. 5: 529.
- Zhang, Q., Li, Z., & Ananth, C. V. (2009). Prevalence and risk factors for anaemia in pregnant women: a population-based prospective cohort study in China. *Paediatric and Perinatal Epidemiology*, 23(4), 282-291.
- Zhang, C., & Rawal, S. (2017). Dietary iron intake, iron status, and gestational diabetes. *The American Journal of Clinical Nutrition*, 106(suppl_6), 1672S-1680S.



APPENDIX A

Ethics Approval Letter from MREC



APPENDIX B

Information sheet and consent form

(Malay version)



UPM
UNIVERSITI PUTRA MALAYSIA

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

RISALAH MAKLUMAT PESERTA

1. Tajuk penyelidikan:

Kajian prospektif pengambilan zat besi dan risiko kencing manis gestasi (GDM) dalam kalangan wanita hamil yang mempunyai status zat besi yang berlainan.

2. Nama Institusi and Nama Penyelidik:

Nama penyelidik dan nama institusi	Tempat kajian dijalankan
Yong Heng Yaw, Universiti Putra Malaysia	1. KKIA Hulu Langat i. Bangi ii. Kajang iii. Bandar Sri Putra iv. Ampang 2. KKIA Petaling i. Puchong ii. Taman Medan iii. Seri Kembangan 3. KKIA Sepang i. Salak ii. Dengkil iii. Pulau Meranti

3. Nama Penaja:

Prof. Dr. Zalilah Mohd Shariff, Profesor, Jabatan Pemakanan dan Dietetik, Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia.

4. Pengenalan:

Anda dijemput untuk menyertai penyelidikan ini kerana anda mengandung dan sedang melawat Klinik Kesihatan Ibu dan Anak (KK) untuk pemeriksaan pra-natal. Risalah ini menjelaskan hal-hal berkenaan penyelidikan tersebut dengan lebih mendalam dan terperinci. Amat penting anda memahami mengapa penyelidikan ini dilakukan dan apa yang dilakukan dalam penyelidikan ini. Sila ambil masa yang secukupnya untuk membaca dan mempertimbangkan dengan teliti penerangan yang diberi sebelum anda bersetuju untuk menyertai penyelidikan ini. Jika ada sebarang kemusykilan ataupun maklumat lanjut yang anda ingin tahu, anda boleh bertanya dengan mana-mana kakitangan yang terlibat dalam penyelidikan ini. Setelah anda berpuashati bahawa anda memahami penyelidikan ini, dan anda berminat untuk turut serta, anda dikehendaki untuk menandatangani Borang Persetujuan atau Keizinan Peserta, pada muka surat akhir risalah ini.

Penyertaan anda dalam penyelidikan ini adalah secara sukarela. Anda tidak perlu menyertai penyelidikan ini jika anda tidak mahu. Anda juga mempunyai hak untuk tidak menjawab mana-mana soalan yang anda tidak mahu jawab. Anda juga boleh menarik diri daripada



UPM
UNIVERSITI PUTRA MALAYSIA

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43100 UPM SERDANG,
SELANGOR, MALAYSIA

penyelidikan ini pada bila-bila masa sahaja. Jika anda tidak mahu menyertai ataupun menarik diri dari penyelidikan ini, tindakan anda tidak akan menjejaskan segala hak dan keistimewaan perubatan kesihatan yang selayaknya anda terima.

Penyelidikan ini telah mendapat kelulusan Jawatankuasa Etika dan Penyelidikan Perubatan, Kementerian Kesihatan Malaysia.

5. Apakah tujuan penyelidikan ini dilakukan?

Tujuan penyelidikan ini dilakukan adalah untuk menentukan hubungan di antara pengambilan zat besi (jumlah zat besi, zat besi heme dan suplemen zat besi) dan risiko kencing manis gestasi (GDM). Tiada rawatan/ ubat akan diberikan.

Penyelidikan ini diperlukan kerana kencing manis gestasi (GDM) semakin meningkat di Malaysia, ia adalah penting untuk mengetahui faktor-faktor risiko yang boleh diubahsuai supaya boleh dijadikan sebagai panduan asas bagi strategi intervensi menangani GDM di masa depan.

Sejumlah 549 wanita akan mengambil bahagian dalam penyelidikan ini. Penyelidikan ini akan berlangsung selama 2 tahun tempoh pembabitan anda dianggarkan selama 7 bulan.

6. Apakah tanggungjawab saya sewaktu menyertai penyelidikan ini?

Sekiranya anda bersetuju untuk menyertai penyelidikan ini, anda perlu mengikut semua prosedur penyelidikan. Anda akan ditemubual (borang soal selidik) dan diukur (berat badan dan sampel darah) pada 3 lawatan susulan:

Soal selidik akan digunakan untuk mendapatkan maklumat mengenai sosio-demografi, sejarah kehamilan, pemakanan semasa mengandung dan suplementasi zat besi. Sampel darah (3ml) akan diambil pada minggu kehamilan ke- 12-14, ke-24-27 dan ke-28-32 untuk mengetahui tahap glukosa, ferritin, hemoglobin dan protein c-reaktif (CRP).



FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

Prosedur penyelidikan:

	Lawatan	Jenis pengukuran
1.	Kemasukan kajian (seawal-awalnya)	a. Borang soal selidik (sosio-demografi)
2.	Lawatan pertama (Kehamilan minggu ke-12 – 14)	a. Borang soal selidik i. pemakanan, ii. suplementasi zat besi iii. aktiviti fizikal b. Pengukuran – berat c. Pengambilan darah (2ml) i. Parameter zat besi ii. Paras glukosa darah
3.	Lawatan ke-2 (Kehamilan minggu ke-24 – 27)	a. Pengambilan darah (3ml) i. Parameter zat besi ii. Paras glukosa darah iii. Protein c-reaktif (CRP)
4.	Lawatan ke-3 (Kehamilan minggu ke-28 – 32)	a. Borang soal selidik i. pemakanan, ii. suplementasi zat besi iii. aktiviti fizikal b. Pengukuran – berat c. Pengambilan darah (2ml) i. Paras glukosa darah

7. Apakah jenis rawatan yang akan saya terima selepas menyertai penyelidikan ini ?

Oleh kerana penyelidikan ini adalah kajian observasi, maka tiada sebarang rawatan atau ubat akan diberikan kepada anda.

8. Apakah risiko dan kesan-kesan sampingan menyertai penyelidikan ini?

Pengambilan darah: Ia boleh menyebabkan kesakitan dan/atau lebam di lokasi lengan anda di mana darah itu diambil.

Risiko psikologi: Anda mungkin mengalami kebimbangan atau keresahan apabila menyelesaikan soal selidik/temubual. Sekiranya anda berasa tertekan, anda mempunyai hak untuk tidak menjawab mana-mana soalan atau menghentikan temuduga dengan segera.



UPM
UNIVERSITI PUTRA MALAYSIA

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

9. Apakah manfaatnya saya menyertai penyelidikan ini?

Anda mungkin tidak mendapat manfaat secara langsung daripada mengambil bahagian dalam penyelidikan ini. Namun demikian, maklumat yang diperolehi daripada penyelidikan ini akan membantu untuk lebih memahami peranan pengambilan zat besi dalam pembentukan GDM dan seterusnya sebagai panduan membentuk strategi pencegahan GDM yang sesuai.

10. Apakah yang akan terjadi sekiranya saya tercedera semasa menyertai kajian ini?

Jika anda tercedera kerana penyertaan anda dalam penyelidikan ini, anda haruslah menghubungi penyelidik kajian anda. Sekiranya kecederaan fizikal/badan atau penyakit terhasil secara langsung akibat daripada prosedur penyelidikan yang dijalankan dalam penyelidikan ini, pihak penaja akan membayar segala kos rawatan berpatutan yang diperlukan. Tetapi pihak penaja tidak akan bertanggungjawab terhadap perbelanjaan perubatan bagi penyakit atau rawatan yang telah wujud sebelum penyertaan anda dalam penyelidikan ini, ataupun mana-mana proses rawatan yang sedang anda ikuti, ataupun sebarang masalah yang timbul sama ada daripada kecuaiannya sendiri atau salah laku yang disengajakan. Walaubagaimanapun, anda tetap tidak kehilangan mana-mana hak anda di sisi undang-undang untuk mendapatkan pampasan sekalipun anda sudah menandatangani borang ini.

11. Siapakah yang membiayai penyelidikan ini?

Kajian ini ditaja sepenuhnya oleh Geran Universiti Putra Malaysia yang akan membayar semua prosedur dan analisi penyelidikan yang berkaitan. Anda juga akan diberi cenderahati bagi setiap lawatan susulan untuk penyelidikan ini.

12. Bolehkah saya enggan menyertai penyelidikan ini?

Penyertaan anda dalam penyelidikan ini adalah secara sukarela. Anda tidak perlu menyertai penyelidikan ini jika anda tidak mahu. Anda juga boleh menarik diri daripada penyelidikan ini pada bila-bila masa sahaja dengan memberitahu penyelidik dan segala sampel darah yang telah diperolehi akan dihapuskan.

13. Bolehkah penyelidikan ataupun penyertaan saya ditamatkan lebih awal daripada yang dirancang?

Ketua penyelidikan atau penaja boleh menamatkan penyelidikan ini ataupun menamatkan penyertaan anda dalam penyelidikan ini pada bila-bila masa, jika ia perlu demi keselamatan anda. Jika penyelidikan ini dihentikan terlebih awal, di atas sebab-sebab tertentu, anda akan dimaklumkan.



FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

14. Adakah maklumat perubatan saya akan dirahsiakan ?

Segala maklumat anda yang diperolehi dalam penyelidikan ini akan disimpan dan dikendalikan secara sulit, bersesuaian dengan peraturan-peraturan dan/ atau undang-undang yang berkenaan.

Sekiranya hasil penyelidikan ini diterbitkan atau dibentangkan kepada orang ramai, identiti anda tidak akan didedahkan tanpa kebenaran anda terlebih dahulu. Pihak-pihak tertentu seperti individu yang terlibat dalam penyelidikan dan rawatan perubatan anda, juruaudit dan jurupantau yang terlatih, pihak penaja atau pihak gabungannya, pihak berkuasa kerajaan atau undang-undang, boleh memeriksa dan membuat salinan laporan perubatan anda jika berkenaan dan diperlukan.

15. Adakah saya akan dimaklumkan hasil penyelidikan?

Semua peserta akan dimaklumkan mengenai hasil penyelidikan.

16. Siapakah yang perlu saya hubungi sekiranya saya mempunyai sebarang pertanyaan?

Anda boleh menghubungi pegawai penyelidik iaitu Dr Yong Heng Yaw pada sambungan telefon 019-2982822 sekiranya anda mempunyai sebarang pertanyaan mengenai penyelidikan ini atau jika anda mengesyaki anda mengalami kecederaan yang terhasil daripada penyelidikan ini dan anda mahukan maklumat tentang rawatannya.

Jika anda mempunyai sebarang pertanyaan berkaitan dengan hak-hak anda sebagai peserta dalam penyelidikan ini, sila hubungi: Setiausaha, Jawatankuasa Etika & Penyelidikan Perubatan, Kementerian Kesihatan Malaysia, melalui talian telefon 03-2287 4032.



BORANG PERSETUJUAN/ KEIZINAN PESERTA

Tajuk Penyelidikan : *Kajian prospektif pengambilan zat besi dan risiko kencing manis gestasi (GDM) dalam kalangan wanita hamil yang mempunyai status zat besi yang berlainan.*

Dengan menandatangani borang ini, saya mengesahkan bahawa :

- Saya telah diberi maklumat tentang penyelidikan di atas secara lisan dan bertulis and saya telah membaca dan memahami segala maklumat yang diberikan dalam risalah ini.
- Saya telah diberikan masa yang secukupnya untuk mempertimbangkan penyertaan saya dalam penyelidikan ini dan telah diberi peluang untuk bertanyakan soalan dan semua persoalan saya telah dijawab dengan sempurna dan memuaskan.
- Saya juga faham bahawa penyertaan saya adalah secara sukarela dan pada bila-bila masa saya bebas menarik diri daripada penyelidikan ini tanpa harus memberi sebarang alasan dan ianya sama sekali tidak akan menjejaskan rawatan perubatan saya pada masa akan datang. Saya tidak mengambil bahagian dalam mana-mana penyelidikan lain pada masa ini. Saya juga memahami tentang risiko dan manfaat penyelidikan ini dan saya secara sukarela memberi persetujuan untuk menyertai penyelidikan ini di bawah syarat-syarat yang telah dinyatakan di atas. Saya faham saya harus mematuhi nasihat dan arahan yang berkaitan dengan penyertaan saya dalam penyelidikan ini daripada pegawai penyelidikan.
- Saya faham bahawa kakitangan penyelidikan, pemantau dan juruaudit terlatih, pihak penaja atau gabungannya, dan pihak berkuasa kerajaan atau undang-undang, mempunyai akses langsung dan boleh menyemak laporan perubatan saya bagi memastikan penyelidikan ini dijalankan dengan betul dan data direkodkan dengan betul. Segala maklumat dan data peribadi akan dianggap sebagai SULIT.
- Saya akan menerima satu salinan 'Risalah Maklumat Peserta dan Borang Persetujuan atau Keizinan Peserta' yang telah lengkap dengan tarikh dan tandatangan untuk dibawa pulang ke rumah.
- Saya bersetuju/ tidak bersetuju* untuk doktor yang merawat keluarga saya diberitahu tentang penyertaan saya dalam penyelidikan ini. (*Potong mana yang tidak berkenaan)

Subjek :

Tandatangan:

Nombor K/P:

No HP:

Nama:

Tarikh :

Penyelidik yang mengendalikan proses menandatangani borang keizinan:

Tandatangan:

Nombor K/P:

Nama:

Tarikh :

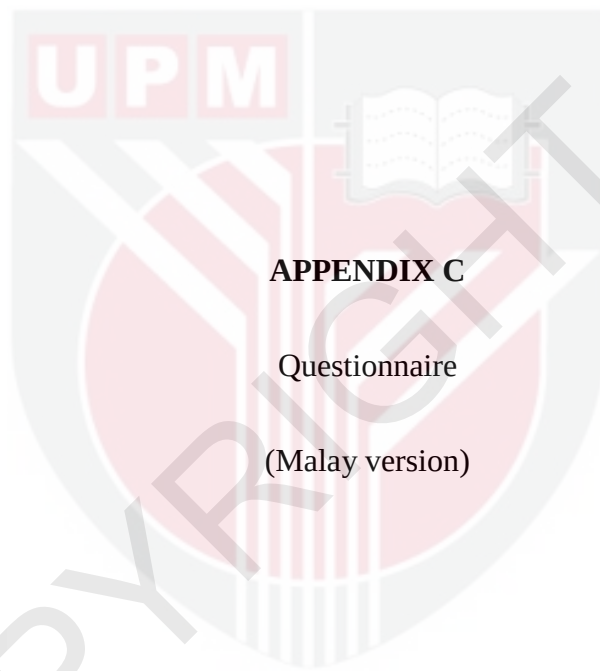
Saksi tidak-berpihak/adil: (Diperlukan; jika subjek adalah buta huruf dan kandungan risalah maklumat peserta disampaikan secara lisan kepada subjek)

Tandatangan:

Nombor K/P:

Nama:

Tarikh :



APPENDIX C

Questionnaire

(Malay version)



FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINES AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

ID:

--	--	--	--	--

BORANG SOAL SELIDIK

**Kajian Tentang Faktor-Faktor Yang Berkaitan Dengan Tahap Hemoglobin
Pada Trimester Ketiga Semasa Hamil Dalam Kalangan Wanita Mengandung
Di Kajang, Selangor**

Penemubual : _____
Tarikh temubual : _____
Klinik : _____
No. Telefon : _____

BAHAGIAN A: MAKLUMAT SOSIO-DEMOGRAFI

1. Tarikh lahir	____(hari)____(bulan)____(tahun)
2. Bangsa	a) Mekayu b) Cina c) India d) Lain-lain, nyatakan:_____
3. Status perkahwinan	a) Bujang b) Berkawin c) Berceraai atau berpisah d) Balu/duda
4. Tahap pendidikan yang tertinggi	____Tidak bersekolah formal ____Darjah ____Tingkatan peralihan ____STPM atau matrikulasi ____Diploma ____Sarjana muda ____Sarjana ____PhD
5. Pekerjaan	
6. Pendapatan sebulan (RM)	RM____ ____Kurang dari RM1,000 ____RM1,000 – RM1,999 ____RM2,000 – RM2,999 ____RM3,000 – RM3,999 ____RM4,000 – RM5,999 ____RM6,000 – RM7,999 ____RM8,000 dan ke atas

BAHAGIAN B: SEJARAH OBSTETRIK

1. Jumlah kali kehamilan (gravidity)	
2. Jumlah kelahiran selepas minggu kandungan ke-20 (parity)	
3. Sejarah anemia semasa kelahiran lepas	YA/TIDAK

BAHAGIAN C: UKURAN ANTROPOMETRI

1. Tinggi (cm)	
2. Berat badan sebelum mengandung (kg)	

BAHAGIAN D: UKURAN BIAKIMIA

1. Hemoglobin (g/dL) semasa minggu ke 28-32	
---	--

BAHAGIAN E: BORANG KEKERAPAN PENGAMBILAN MAKANAN

Kod	Jenis makanan	Kekerapan pengambilan (beberapa kali se-)				Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Hari	Minggu	Bulan	Tidak makan		
A. Daging dan hasil daging (*bagi peserta bukan islam)							
A1	Ayam					Ketul	
A2	Itik					Ketul	
A3	Burung puyuh					Ekor	
A4	Lembu/kerbau					Kotak mancis	
A5	Kambing					Kotak mancis	
A6	Paru/hati/limpa/buah pinggang					Ketul	
A7	Perut					Ketul	
A8	*Babi					Kotak mancis	
B. Ikan dan makanan laut							
B1	Ikan laut					Keping	
						Ekor	
B2	Ikan air tawar					Keping	
						Ekor	
B3	Udang basah					Ekor	
B4	Sotong basah					Potong	
B5	Ketam					Ekor	
B6	Kekerang (kerang, lala, remis, kupang, mentarang)					Sudu makan	
B7	Siput sedut (Belitung, siput buluh)					Sudu makan	
B8	Ikan bilis					Sudu makan	
B9	Ikan sardine dalam tin					Sudu makan	
B10	Ikan tuna dalam tin					Sudu makan	
B11	Ikan jeruk/perkasam					Keping	
B12	Sotong kering					Keping	
B13	Keropok ikan/udang/sotong/ketam					Keping	
B14	Keropok lekor					Keping	
B15	Ikan kering/masin					Ekor	

Kod	Jenis makanan	Kekerapan pengambilan (beberapa kali se-)				Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Hari	Minggu	Bulan	Tidak makan		
C. Telur							
C1	Telur ayam					Biji	
C2	Telur itik					Biji	
C3	Telur puyuh					Biji	
C4	Telur masin					Biji	
D. Kekacang dan hasilnya							
D1	Kekacang (kacang hijau, kacang parang, kacang kuda, kacang merah)					Sudu makan	
D2	Kacang tanah					Sudu makan	
D3	Taufufa					Keping	
D4	Tauhu					Keping	
D5	Tempe					Keping	
E. Sayur-sayuran							
E1	Sayuran berdaun hijau (kangkung/sawi/kalian/daun salad/ucuk ubi/pucuk paku)					Sudu makan	
E2	Bendi					Sudu makan	
E3	Sayuran kekacang lain (kacang panjang/buncis/botol)					Sudu makan	
E4	Sayuran berubi (ubi kentang/keladi/keledai/ubi kayu)					Sudu makan	
E5	Sayuran kobis (kobis/brokoli/bunga kobis)					Sudu makan	
E6	Cili						
E7	Tomato						
E8	Terung						
E9	Sayuran berbuah lain (petola, labu, timun, putik jagung)						
E10	Taugeh					Sudu makan	
E11	Sayuran asin/kering					Sudu makan	
E12	Ulam-ulam					Sudu makan	
E13	Cendawan basah					Sudu makan	
E14	Cendawan kering					Sudu makan	

Kod	Jenis makanan	Kekerapan pengambilan (beberapa kali se-)				Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Hari	Minggu	Bulan	Tidak makan		
F. Buah-buahan							
F1	Betik					Potong	
F2	Jambu batu					Keping	
F3	Limau manis tempatan					Biji	
F4	Magga					Potong	
F5	Nenas					Potong	
F6	Pisang					Biji	
F7	Tembikai					Potong	
F8	Belimbing					Biji	
F9	Nangka/cempedak					Ulas	
F10	Epal					Biji	
F11	Oren/mandarin					Biji	
F12	Pir/lai					Biji	
F13	Anggur					Biji	
F14	Durian					Ulas	
F15	Manggis						
F16	Rambutan					Biji	
F17	Longan segar					Biji	
F18	Laici segar					Biji	
F19	Tembikai susu					Potong	
F20	Buah-buahan dalm tin (laici, longgan, nenas)					Potong	
F21	Buah-buahan kering (kurma, prun, kismis)					Potong	
F22	Buah-buahan jeruk/acar					Sudu makan	
F23	Kelapa muda					Sudu makan	

BAHAGIAN F: PENGAMBILAN SUPLEMEN

1. Adakah anda mengambil sebarang vitamin/mineral/suplemen makanan bukan vitamin/mineral (seperti minyak ikan, spirulina, royal jelly dan lain-lain) dalam tempoh 30 hari yang lepas?

_____Ya

_____Tidak

2. Sila senaraikan jenis, jenama produk dan kekerapan pengambilan bagi vitamin/mineral/suplemen makanan bukan vitamin atau mineral yang diambil:

No.	Jenis dan jenama produk	Kekerapan pengambilan (beberapa kali se-)			Berapa biji setiap kali makan
		Hari	Minggu	Bulan	