



UNIVERSITI PUTRA MALAYSIA

***FACTORS ASSOCIATED WITH POSTPARTUM WEIGHT RETENTION
AMONG CHILDBEARING AGE WOMEN IN SELECTED HEALTH
CLINICS IN SEREMBAN, NEGERI SEMBILAN, MALAYSIA***

WAN NOOR FATEHAH BINTI WAN ZAKARIA

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By

WAN NOOR FATEHAH BINTI WAN ZAKARIA

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Master of Science**

May 2018

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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WAN NOOR FATEHAH BINTI WAN ZAKARIA

May 2018

Chair : Assoc. Prof. Barakatun Nisak Mohd Yusof, PhD
Faculty : Medicine and Health Sciences

Postpartum weight retention (PWR) increases the risk of overweight and obesity in women of childbearing age. The aim of this study was to determine the factors associated with PWR in childbearing age women at selected health clinics in Negeri Sembilan at 6 months postpartum. The factors are socio-demographic characteristics, obstetrical factors, perinatal factors, lifestyle behaviours, dietary glycemic index (GI) and glycemic load (GL) and postpartum depression. This cross-sectional study was a part of Seremban Cohort Study (SECOST) and conducted at the Seremban, Ampangan and Senawang Health Clinics. The data collection was conducted over a period of 8 months, from January to August 2015. Ethical approval was obtained from the Ministry of Health Malaysia.

A total of 226 respondents aged 21 to 46 years (31 ± 4.56 years) from Seremban, Ampangan and Senawang Health Clinics were recruited in this study. The response rate was 95%. The majority of respondents were Malay ethnic and married, employed and had attained tertiary level of education with monthly household income more than RM3000. The majority of the respondents had a vaginal delivery, multiparous and had a waist circumference more than 80 cm. The average of gestational weight gain (GWG) was 11 kg and 44.20% gained adequate GWG. The average of PWR was 2.59 ± 5.26 kg and 27.40% retained more 5 kg of weight at 6 months postpartum.

Factors correlated significantly with PWR at 6 months were parity ($r = -0.137$, $p = 0.039$), pre-pregnancy weight ($r = -0.254$, $p = 0.001$), pre-pregnancy Body Mass Index (BMI) ($r = -0.297$, $p = 0.001$), GWG ($r = 0.529$, $p = 0.001$), percentage of protein intake ($r = 0.143$, $p = 0.032$), intake of vitamin A ($r = -0.131$, $p = 0.050$), duration of exclusive breastfeeding at any times within 6 months ($\chi^2 = 7.460$, $p = 0.024$) and waist circumference at 6 months postpartum ($F = 7.585$, $p = 0.045$).

Multiple linear regression analysis using a Stepwise method has shown five factors, namely; waist circumference at 6 months postpartum (Beta = 0.753, $t = 9.900$, $p = 0.001$); pre-pregnancy BMI (Beta = -0.718, $t = -9.044$, $p = 0.001$); GWG (Beta = 0.413, $t = 8.050$, $p = 0.001$); duration of exclusive breastfeeding at any times within 6 months (Beta = -0.128, $t = -2.726$, $p = 0.007$); and height (Beta = -0.120, $t = -2.423$, $p = 0.016$) which were found to be the predictors for PWR. These predictors explained about 50.50 % of the variation in PWR according to the Stepwise Method (adjusted $R^2=0.505$).

In conclusion, high waist circumference, high GWG, low pre-pregnancy BMI, shorter duration of exclusive breastfeeding and short stature were associated with high PWR among childbearing age women.

Keywords: Postpartum weight retention, cross-sectional study, waist circumference, gestational weight gain, pre-pregnancy BMI, breastfeeding

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains.

FAKTOR BERKAITAN DENGAN PENGEKALAN BERAT BADAN SELEPAS BERSALIN DALAM KALANGAN WANITA PADA USIA MELAHIRKAN ANAK DI KLINIK KESIHATAN YANG TERPILIH DI SEREMBAN, NEGERI SEMBILAN, MALAYSIA

Oleh

WAN NOOR FATEHAH BINTI WAN ZAKARIA

Mei 2018

Pengerusi: Prof Madya Barakatun Nisak Mohd Yusof, Ph.D
Fakulti : Perubatan dan Sains Kesihatan

Pengekalan berat badan selepas bersalin (PWR) meningkatkan risiko berat badan berlebihan dan obesiti pada wanita di usia melahirkan anak. Tujuan kajian ini adalah untuk mengenalpasti faktor-faktor yang berkaitan dengan PWR pada wanita hamil di klinik kesihatan terpilih di Negeri Sembilan pada 6 bulan selepas bersalin. Faktor-faktor tersebut adalah seperti ciri-ciri sosio-demografi, faktor obstetrik, faktor perinatal, tingkah laku gaya hidup, indeks glisemik diet (GI) dan beban glisemik (GL) dan gejala kemurungan selepas bersalin. Kajian keratan rentas ini adalah sebahagian daripada *Seremban Cohort Study (SECOST)* dan dijalankan di Klinik Kesihatan Seremban, Ampangan dan Senawang. Pengumpulan data dijalankan selama 8 bulan, daripada bulan Januari sehingga Ogos 2015. Kelulusan beretika telah dapat daripada Kementerian Kesihatan Malaysia.

Seramai 226 responden berumur 21 hingga 46 tahun (31 ± 4.56 tahun) dari Klinik Kesihatan Seremban, Ampangan dan Senawang telah direkrut dalam kajian ini. Kadar respons penglibatan sebanyak 95%. Majoriti responden adalah daripada etnik Melayu dan sudah berkahwin, bekerja dan mempunyai pendidikan peringkat tertiary dengan pendapatan bulanan isi rumah adalah lebih daripada RM3000. Majoriti responden bersalin secara normal, mempunyai bilangan anak lebih daripada satu dan mempunyai ukurlilit pinggang lebih daripada 80 cm. Purata kenaikan berat badan semasa mengandung (GWG) adalah 11 kg dan 44.20% mencukupi GWG. Purata PWR ialah 2.59 ± 5.26 kg dan 27.40% telah mengekalkan berat badan lebih daripada 5 kg pada 6 bulan selepas bersalin.

Faktor-faktor yang mempunyai korelasi yang signifikan dengan PWR pada 6 bulan adalah pariti ($r = -0.137$, $p = 0.039$), berat pra-kehamilan ($r = -0.254$, $p = 0.001$), pra-kehamilan Indeks Jisim Badan (BMI) ($r = -0.297$, $p = 0.001$), GWG ($r = 0.529$, $p =$

0.001), peratusan pengambilan protein ($r = 0.143$, $p = 0.032$), pengambilan vitamin A ($r = -0.131$, $p = 0.050$), tempoh penyusuan susu ibu secara eksklusif pada mana-mana masa dalam 6 bulan ($\chi^2 = 7.460$, $p = 0.024$) dan ukurlilit pinggang pada 6 bulan selepas bersalin ($F = 7.585$, $p = 0.045$).

Analisis regresi linier berganda menggunakan kaedah *Stepwise* telah menunjukkan lima faktor, iaitu; ukurlilit pinggang pada 6 bulan selepas bersalin (Beta = 0.753, $t = 9.900$, $p = 0.001$); pra-kehamilan BMI (Beta = -0.718, $t = -9.044$, $p = 0.001$); GWG (Beta = 0.413, $t = 8.050$, $p = 0.001$); tempoh penyusuan susu ibu secara eksklusif pada mana-mana masa dalam 6 bulan (Beta = -0.128, $t = -2.726$, $p = 0.007$); dan ketinggian (Beta = -0.120, $t = -2.423$, $p = 0.016$ merupakan peramal untuk PWR. Peramal ini menunjukkan 50.50% variasi dalam PWR adalah menurut kaedah *Stepwise* (*adjusted* $R^2 = 0.505$).

Kesimpulannya, ukurlilit pinggang yang tinggi, GWG yang tinggi, BMI pra-kehamilan yang rendah, tempoh penyusuan susu ibu secara eksklusif yang pendek dan kurang ketinggian adalah faktor penyumbang kepada tinggi PWR dalam kalangan wanita pada usia melahirkan anak.

Kata kunci: Pengekalan berat badan selepas bersalin, kajian keratan rentas, ukurlilit pinggang, peningkatan berat badan semasa mengandung, BMI pra-kehamilan

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Barakatun Nisak Mohd Yusof, PhD

Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Zalilah Mohd Shariff, PhD

Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

Zulida Rejali, PhD

Senior Medical Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

ROBIAH BINTI YUNUS, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

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Name and Matric No.: Wan Noor Fatehah binti Wan Zakaria (GS41081)

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Supervisory
Committee: _____

Signature: _____

Name of Member of
Supervisory
Committee: _____

Signature: _____

Name of Member of
Supervisory
Committee: _____

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LIST OF ABBREVIATIONS

PWR	Postpartum Weight Retention
GWG	Gestational Weight Gain
BMI	Body Mass Index
GI	Glycemic Index
GL	Glycemic Load
RNI	Recommended Nutrient Intakes
NCCFN	National Coordinating Committee on Food and Nutrition
IPH	Institute of Public Health
IOM	Institute of Medicine



GLOSSARY OF TERMS

Postpartum Weight Retention (PWR) at 6 months	Difference between body weight at 6 months postpartum and body weight before the pregnancy (Xuto et al., 2012)
Gestational Weight Gain (GWG)	The difference between weight measured at 38 to 40 th weeks of gestation and pre-pregnancy weight (Yong et al., 2017)
Dietary Glycemic Index (GI)	A classification of carbohydrate-rich foods according to the rise in blood glucose after ingestion (Jenkins et al., 1981)
Dietary Glycemic Load (GL)	The glycemic load (GL) of the diet is the product of the amount of available carbohydrate for each food item and the GI of the food, summed for all foods consumed (Jenkins et al., 1981; Brand-Miller et al., 2002; Flood et al., 2006)
Perinatal Factors	Perinatal factors include maternal height, GWG, pre-pregnancy body weight and pre-pregnancy BMI and waist circumference at 6 months postpartum
Exclusive breastfeeding	No other food or drink, not even water, except breast milk (including milk expressed or from a wet nurse) for 6 months of life, but allows the infant to receive ORS, drops and syrups (vitamins, minerals and medicines) (WHO, 2001).
Exclusive breastfeeding at any time within 6 months	No other food or drink, not even water, except breast milk (including milk expressed or from a wet nurse) at any time within 6 months of life, but allows the infant to receive ORS, drops and syrups (vitamins, minerals and medicines)

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CHAPTER 1

INTRODUCTION

1.1 Study Background

Women of childbearing age are at particularly high risk for substantial weight gain during their reproductive years (Xiao et al., 2014). The substantial weight gain is due to pregnancy. Pregnancy is a time when a woman intentionally gains weight to support her developing fetus and the pregnancy-related adaptations including the growth of the placenta (Tussing-Humphreys, Thomson, Hemphill, Goodman, & Landry, 2017). However, more than 50% of the childbearing age women retained their postpartum weight (Siega-Riz et al., 2010).

PWR is a critical nutritional problem for women of childbearing age (Ma et al., 2015). It is defined as the difference between body weight at a given time point during postpartum and pre-pregnancy body weight (IOM, 2009). Women who are retained at least 0.45 kg and more at postpartum can be considered as having PWR (Siega-Riz et al., 2010). Although, a small percentage of women (15%) returned to their body weight before pregnancy by 6 weeks postpartum (Walker et al., 2004), most of them (48%) are usually get back to their weight before pregnancy by 6 months of postpartum (Bogaerts & Van den Bergh, 2013). Returning to pre-pregnancy weight may apply to those who are gaining weight appropriately during pregnancy (IOM, 2009). The proportion of women with excess PWR be expected to shortly with the concurrent increasing rate of obesity in women globally.

In addition, excessive PWR may pose a threat to reproductive and future pregnancies by increasing the risk of infertility (Endres et al., 2016), gestational diabetes mellitus (Ehrlich et al., 2012) and pre-eclampsia (Hoff, Cai, Okah, & Dew, 2009). Also, PWR influences obesity development in childbearing age women (Whitaker, Young-Hyman, Vernon, & Wilcox, 2014). A previous study demonstrates that PWR more than 4.50 kg has been associated with long-term overweight status at 12 months postpartum (Linné, Dye, Barkeling, & Rössner, 2004).

Weight gain leading to obesity development in childbearing age women is primary concerns because of many adverse health consequences have been related with weight gain, overweight and obesity in women (IOM, 1990). These include hypertension, diabetes mellitus type 2, ischemic heart disease, gall bladder disease, osteoarthritis and a few types of cancers (Ogden & Carroll, 2010).

Various factors identified associated with PWR. These factors include lifestyle behaviours and psychosocial characteristics which have been altered during the postpartum period due to changing demands of a baby. Women have to make use to emotional, physical and social changes during the adjustment to motherhood (Hoffenaar, van Balen, & Hermanns, 2010). They always prioritise their duties and put the health of their baby first, even at the expense of improving their own health (Carter-Edwards et al., 2009).

Besides, for perinatal factors, pre-pregnancy BMI and gestational weight gain (GWG) is a risk factor for high PWR (Hollis et al., 2017; Xuto, Sinsuksai, Piaseu, Nityasuddhi & Phupong, 2012; Vesco et al., 2009). Increasing GWG has been reported in several industrialised nations which might lead to the increasing prevalence of obesity in women (IOM, 2009). Furthermore, for the socio-demographic characteristics, maternal age (Kac et al., 2004) and education (Yong et al., 2017; Krause et al., 2011) may influence PWR. Mode of delivery (Kapinos, Yakusheva, & Weiss, 2017) and parity (Hill et al., 2017) also had association with PWR. However, dietary GI and GL were not associated with PWR (Oken, Taveras, Popoola, Rich-Edwards, & Gillman, 2007). The World Health Organization (WHO) reported that the increased consumption of more energy-dense, nutrient-poor foods, combined with reduced physical activity, has led to widespread obesity (He et al., 2014).

1.2 Problem Statement

PWR in women of childbearing age is an arising problem in the global obesity epidemic (Cheng, Walker, Tseng, & Lin, 2011). A systematic review of longitudinal, retrospective cohort study and cross-sectional about PWR among Asian populations found that the women in China, Taiwan and Korea tend to have a higher PWR than other Asian women (Cheng et al., 2011). It is observed that the mean amount of weight retention at 6 months postpartum ranging from 1.56 - 4.10 kg among Asian women. This amount of weight observed is relatively lower than those observed among North America women (1.75 - 5.64 kg) (Mannan, Doi, & Mamun, 2013). In addition, GWG was the most common significant determinant of PWR and other factors that significantly associated with PWR in this systematic review include pre-pregnancy weight, negative body image, less belonging social support, parity, energy intake and breastfeeding (Cheng et al., 2011). Based on this systematic review, most of the PWR studies were saturated in China, but limited studies in other Asian countries, especially in Malaysia. Moreover, only some factors were studied which associated with PWR.

Excessive PWR is recognised as a substantial factor that affect to the future development of overweight and obesity, but few studies have measured the PWR in Malaysia. So far, two studies reported on PWR in Malaysia (Yong, Zalilah, & Jamilah, 2017; Fariza et al., 2015). A research by Yong and colleagues (2017) showed 32.50% of women retained ≥ 4.55 kg at 6 months postpartum with a average 2.53 ± 4.01 kg (Yong et al., 2017). Meanwhile, Fariza and colleagues (2015) reported that 33.90% of women retained more than 5 kg with average PWR was 3.10 ± 4.80 kg (Fariza et al., 2015). The factors that associated with PWR were GWG (Yong et al., 2017; Fariza et al., 2015), maternal education, pre-pregnancy BMI (Yong et al., 2017), energy intake,

physical activity, breastfeeding, hot stone compression (Fariza et al., 2015). Both studies recorded that one-third of women retained their weight at 6 months postpartum. This is a cause of concern as the prevalence of overweight in women age more than 30 years old exceeded 50% in Malaysia (WHO, 2010). While PWR is a rising problem in the pathway leading to obesity in childbearing age women, relevant data among Malaysian women are scarce and its associated factors are yet to be confirmed.

It can be speculated that the prevalence of women with excess PWR may be overwhelming. The basis of this speculation was based on the previous study who found that the average BMI assessed at 6 months postpartum was 26.40 kg/m² categorised as overweight (Shyam et al., 2013). Therefore, research on PWR is essential to be studied.

Various factors have been studied to associate with PWR, including maternal age, GWG, pre-pregnancy BMI, parity, reduce physical activity level at postpartum, sleep duration, and breastfeeding practices. Maternal ages of less than 20 years and more than 30 or 40 years (Kac, Benicio, Velásquez-Meléndez, & Valente, 2004; Olson, Strawderman, Hinton, & Pearson, 2003) were found to be related with high PWR, while other researches have not found such association (Lyu, Lo, Chen, Wang, & Liu, 2009; Taveras et al., 2011). Besides, higher PWR was found in underweight women with excess GWG (Ashley-Martin & Woolcott, 2014). Moreover, primiparas are more prone to have higher PWR than multiparas (To & Wong, 2009). However, a study in Taiwan reported that primiparas had a lower PWR (Huang et al., 2010). However, these findings were always not consistent which makes it difficult to make a concrete conclusion.

Furthermore, when it comes to dietary intake, the focus has been given to energy intake in the postpartum period (Olson et al., 2003), with limited data on other nutrients including dietary glycemic index (GI) and glycemic load (GL). Dietary GI and GL have been shown to relate to obesity among Korean women significantly. In other word, women who had a high intake of dietary GI/ GL were more likely to become obese (Youn et al., 2012). However, very limited study reported on the association between dietary GI/GL and PWR. Dietary GI was not associated with PWR (Oken et al., 2007), but dietary GL was associated with PWR (Knudsen et al., 2013).

Regarding breastfeeding practice, results by several studies showed a negative association between breastfeeding and PWR (Baker et al., 2008; Jarlenski, Bennett, Bleich, Barry, & Stuart, 2014). Although breastfeeding is associated with the process to utilise energy expenditure, its effect on postpartum weight loss is not consistent. Some study observed that lactation must be continued up to 6 months to have clear benefits (Dewey, 2004). However, a study among Thai women reported that breastfeeding was not related with PWR at 6 months after delivery (Xuto et al., 2012).

1.3 Research Questions

- a) What is the prevalence of excess PWR in childbearing age women?
- b) What are the associations of the selected factors (socio-demographic, obstetric and perinatal, lifestyle behaviours, dietary GI/GL and postpartum depression) with PWR in childbearing age women?
- c) What are the predictors for PWR?

1.4 Research Objectives

1.4.1 General Objectives

To determine the factors associated with postpartum weight retention among childbearing age women in selected health clinics in Seremban, Negeri Sembilan, Malaysia.

1.4.2 Specific Objectives

- 1) To determine the socio-demographic, obstetrical and perinatal factors, lifestyle behaviours, dietary GI/ GL and postpartum depression in women of childbearing age.
- 2) To determine PWR in women of childbearing age.
- 3) To determine the association of socio-demographic (i.e. age, years of formal education, household income, household size), obstetric (i.e. number of pregnancy, parity) and perinatal (i.e. height, pre-pregnancy weight, pre-pregnancy BMI, waist circumference at 6 months postpartum, GWG), lifestyle behaviours (i.e. dietary intake, physical activity, sleep duration, breastfeeding), dietary GI/GL and postpartum depression with PWR in women of childbearing age.
- 4) To determine the differences in socio-demographic (i.e. ethnicity, education level, occupation status), obstetric (i.e. mode of delivery) and perinatal (i.e. height, pre-pregnancy BMI, waist circumference at 6 months postpartum, GWG), lifestyle behaviours (i.e. breastfeeding) and dietary GI/GL with PWR in women of childbearing age.
- 5) To determine the contribution of all the factors or variables to PWR in women of childbearing age.

1.5 Hypotheses

- 1) There was a significant association of socio-demographic factors (i.e. age, years of formal education, household income, household size), obstetric (i.e. number of pregnancy, parity) and perinatal (i.e. height, pre-pregnancy weight, pre-pregnancy BMI, waist circumference at 6 months postpartum, GWG), lifestyle behaviours (i.e. dietary intake, physical activity, sleep duration, breastfeeding), dietary GI/GL and postpartum depression with PWR in women of childbearing age.
- 2) There was a significant mean difference in socio-demographic factors (i.e. ethnicity, education level, occupation status), obstetric (i.e. mode of delivery) and perinatal (i.e. height, pre-pregnancy BMI, waist circumference at 6 months postpartum, GWG), lifestyle behaviours (i.e. breastfeeding) and dietary GI/GL with PWR in women of childbearing age.
- 3) There were contributions from all these factors with PWR in women of childbearing age.

1.6 Significance of the Study

PWR promotes obesity development among childbearing age women. This is important in the present context because of the prevalence of obesity among Malaysian women is increasing, especially those of childbearing age as compared to the other age group (IPH, 2015). The findings of this study provide fundamental data on PWR in a sample of childbearing age women in Malaysian. Understanding the factors that contribute to the weight retention is essential for healthcare professionals in understanding the needs of women during this critical period.

Moreover, better knowledge regarding common and modifiable risk factors of PWR is critical to the design targeted interventions. These determinants are essential to prevent excess PWR, which finally reduces the risk of overweight development in childbearing age women.

Furthermore, data from this study can facilitate health care professionals to plan the appropriate program to assist in weight reduction at a postpartum period in women of childbearing age. The postpartum period is a golden time in view women are more susceptible to behaviour change recommendations and therefore may offer an outstanding opportunity to improve weight-associated behaviours (Lumley et al., 2004).

Significant numbers of women are retaining weight after a live birth and are at risk to become overweight or obese. Efforts to reduce overweight and obesity among childbearing age women should consider focusing on women during their pregnancy time. Therefore, the outcomes of this study may help intervention studies to conduct an intervention that follows the recommendation for GWG and at the same time may

reduce PWR. Also intervention program also should be promoted to help women get back to their body weight before pregnancy starts from pregnancy until postpartum.

At present, only two published information on PWR and factors associated with PWR among women in Malaysia. Thus, this study could be used as reference data for future researchers to investigate PWR in Malaysia further. The study findings could also be beneficial for policy makers and health professionals to develop effective strategies for postpartum weight loss.

1.7 Conceptual Framework

Various factors identified that may potentially influence PWR is conceptualised in Figure 1.1. The dependent variable was postpartum weight retention at 6 months. Time to measure PWR at 6 months after delivery because failure to lose pregnancy-related weight in an appreciable time of 6 months after delivery is an important indicator of obesity in the middle of life (Bogaerts & Van den Bergh, 2013). Many previous studies also used continuous data for PWR (Knudsen, Heitmann, Halldorsson, Sørensen, & Olsen, 2013; Lee, Hwang, Liou, & Chien, 2011).

This framework (Figure 1.1) showed that several demographic (i.e., age, ethnicity, education level, years of formal education, monthly household income, household size), obstetrical information (i.e., number of pregnancy, parity, mode of delivery), perinatal (i.e., height, pre-pregnancy weight, pre-pregnancy BMI, waist circumference, GWG), postpartum depression, dietary glycemic index and glycemic load, behavioural factors (i.e., dietary, physical activity, sleep duration and breastfeeding), psychosocial factors (i.e., perceived body image satisfaction, social support and drive for thinness) and hormones (i.e., leptin, ghrelin, growth hormones, insulin) were associated with PWR.

As shown in Figure 1.1, the associated factors (socio-demographic, obstetric, perinatal, behavioural, dietary glycemic index and glycemic load and postpartum depression) were related to each other that can lead to PWR (Xuto et al, 2012). In addition, psychosocial factors (Huang et al., 2010) and hormone factor (Baban et al., 2010) also lead to PWR (Cheng, 2013), but these two factors were not studied in this research because no association with PWR (Xuto et al., 2012). This study focus on postpartum depression because this is the common factor studied at the postnatal period.

Most of the studies reported the direct relationship between all the factors and PWR (Yong et al., 2017; Fariza et al., 2015; He et al., 2014; Boghossian et al., 2013; Siegariz et al., 2010; Huang et al., 2010; Oken et al., 2007).

Most of the studies reported the significant association between GWG and pre-pregnancy BMI with PWR. GWG is the strongest predictor of PWR (Waage et al., 2016; Xuto, Sinsuksai, Piaseu, Nityasuddhi, & Phupong, 2012; Yong et al., 2017). Women who had excessive GWG retained higher postpartum weight, while, pre-pregnancy BMI was negatively related with PWR. Underweight women retained high

PWR (Bogaerts & Van den Bergh, 2013; Lyu et al., 2009; Ma et al., 2015; Pedersen et al., 2011; Yong et al., 2017).

Maternal age (Kac et al., 2004), maternal education (Amorim, Ro, Neovius, Lourenc, & Amanda, 2007; Yong et al., 2017) and parity (Huang et al., 2010; Lee et al., 2011; Lyu et al., 2009) were associated with PWR.. In addition, amount of calories consumed was significantly associated with 6 month PWR (Lyu et al., 2009). Shorter sleep duration was related with high PWR and high waist circumference at 3 years postpartum (Taveras et al., 2011). Moreover, breastfeeding (Baker et al., 2008) and physical activity (Xuto et al., 2012) were negatively associated with PWR at 6 months postpartum. A study among Taiwanese showed that there is negative correlation between postpartum depression and PWR among normal BMI women at 6 months after delivery (Huang et al., 2010).

In this study, the independent variables included are socio-demographic factors which are age, ethnicity, level of education, years of formal education, employment status, monthly household income and household size. Obstetrical information is the mode of delivery, number of pregnancy and parity. Perinatal factors are height, pre-pregnancy weight and BMI, weight and BMI at 6 months postpartum, waist circumference at 6 months postpartum and GWG. Lifestyle behaviours at 6 months postpartum are dietary intake, physical activity, sleep duration and breastfeeding. Other factors that included in this study are calculated dietary GI and GL and postpartum depression.

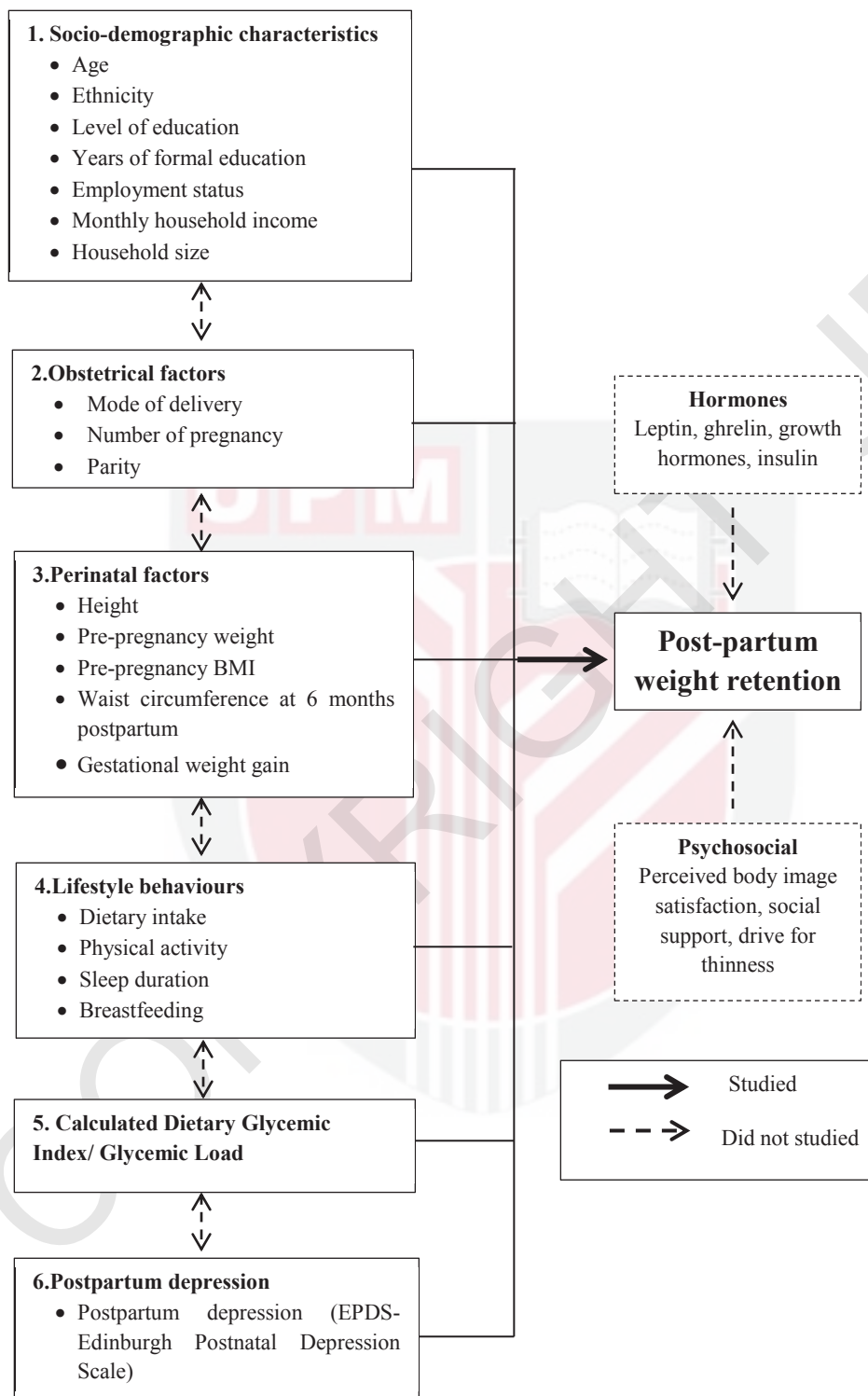


Figure 1.1: Conceptual Framework of Factors Associated with Postpartum Weight Retention at 6 months postpartum

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BIODATA OF STUDENT

Wan Noor Fatehah binti Wan Zakaria was born on 28th February, 1990 in Kota Bharu, Kelantan. She obtained her primary school in Sekolah Kebangsaan Kedai Buloh 1 (1997-2002), then secondary school in Sekolah Menengah Kebangsaan Ismail Petra (2003-2007), and continued her foundation in Penang Matriculation College (2008-2009). She was accepted in Universiti Putra Malaysia in Selangor in 2009. She studied Nutrition and Community Health, Faculty of Medicine and Health Sciences. In 2014, she was accepted in Community Nutrition, Faculty of Medicine and Health Science, UPM under the Supervisor of Associate Professor Dr. Barakatun Nisak Mohd Yusof.



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