

UNIVERSITI SAINS MALAYSIA



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**MIDWIVES' AND NURSES' KNOWLEDGE AND CONFIDENCE
LEVEL IN RELATION TO OBESITY AND ADIPONECTIN IN
EARLY PREGNANCY IN HOSPITAL UNIVERSITI SAINS
MALAYSIA (HUSM): A COMPARATIVE STUDY**

by

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**Dissertation submitted in partial fulfillment of the
requirements of the degree of Bachelor of Health Sciences
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TABLE OF CONTENTS

TABLE OF CONTENTS.....	i
LIST OF TABLES AND FIGURES.....	v
ABBREVIATION.....	vi
ABSTRACT.....	vii
ABSTRAK.....	ix
DECLARATION.....	xi
CERTIFICATE.....	xii
ACKNOWLEDGEMENT.....	xiii
DEFINITION OF KEY TERMS.....	xiv
CHAPTER 1.....	1
INTRODUCTION.....	1
1.1 Introduction.....	1
1.2 Background of the Study.....	1
1.3 Rationale for the Study.....	4
1.4 Problem Statement.....	5
1.5 Purpose of the Study.....	6
1.6 Aims of the Study.....	6
1.6.1 <i>General Objective</i>	7
1.6.2 <i>Specific Objectives</i>	7
1.7 Research Questions.....	7
1.8 Research Hypothesis.....	8
1.9 Justification for, and Significance of the Study.....	8
CHAPTER 2.....	11
LITERATURE REVIEW.....	11
2.1 Introduction.....	11
2.2 Incidence and Prevalence of Obesity.....	11
2.3 Relationship of Obesity and Adiponectin Level.....	14
2.4 Risk of Low Adiponectin Level in Pregnancy.....	16
2.4.1 <i>Breast Cancer</i>	16
2.4.2 <i>Pyelonephritis</i>	17
2.4.3 <i>Metabolic Syndrome</i>	17

2.4.4 Gestational Diabetes Mellitus (GDM).....	18
2.4.5 Preeclampsia (PE)	20
2.4.6 Large-for-gestational Ages Infant	21
2.5 Adiponectin and Increased Risk for Adverse Outcomes of Pregnancy, Delivery and Birth.....	21
2.5.1 Increased maternal risk	21
2.5.2 Increased fetal risk	22
2.5.3 Future health risks for the woman: Diabetes mellitus type 2 (DM2).....	23
2.5.4 Management of obesity and knowledge on influence of adiponectin level to obesity pregnancy.....	25
2.6 Theoretical Framework.....	26
CHAPTER 3	27
METHODOLOGY	27
3.1 Introduction	27
3.2 Research Design.....	28
3.3 Population and Setting	29
3.4 Sample.....	30
3.4.1 Sample Size	30
3.4.2 Sampling Method.....	31
3.4.2.1 Inclusion and Exclusion Criteria.....	31
3.5 Instrumentation	32
3.5.1 Instrument.....	33
3.5.2 Measurement of Variables	34
3.5.3 Translation of Instrument.....	35
3.5.4 Issue of Rigor, Validity and Reliability of the Data Collection Instrument.....	35
3.6 Ethical Considerations.....	36
3.7 Data Collection Methods	37
3.8 Data Analysis	39
CHAPTER 4	40
RESULT.....	40
4.1 Introduction	40
4.2 Sociodemographic Data	40
4.3 Knowledge Score on Relation of Adiponectin and obesity of Nursing Staffs.....	43

4.4 Confidence Level of Nursing Staffs in Providing Care and Health Education.....	45
4.5 Factors that Affecting Knowledge Score on Relation of Adiponectin and Obesity of Nursing Staffs	48
4.6 Association of Knowledge Level on Relation of Adiponectin and Obesity with Confidence Level of Nursing Staffs.....	50
CHAPTER 5.....	52
DISCUSSION.....	52
5.1 Population of Midwives in the Maternity Unit	52
5.2 Knowledge of Nursing Staffs on Relation of Adiponectin and Obesity	52
5.3 Association of Knowledge Score on Relation of Aiponectin and Obesity with Confidence Level in Providing Care and Health Education	53
5.4 Findings and Its Relationship to Theoretical Framework	54
CHAPTER 6.....	56
CONCLUSION AND RECOMMENDATION.....	56
6.1 Conclusion	56
6.2 Strengths and Limitations.....	57
6.3 Recommendations	58
6.3.1 Nursing Practice	58
6.3.2 Nursing Education.....	58
6.3.3 Nursing Research.....	59
6.4 Contribution to the Theory Development	60
REFERENCES	62
APPENDICES.....	70
APPENDIX 1 - RESEARCH INFORMATION FOR NURSES AND MIDWIVES	70
LAMPIRAN 1 – MAKLUMAT KAJIAN BAGI JURURAWAT DAN JURURAWAT KEBIDANAN... 73	
APPENDIX 2 – NURSE/MIDWIFE INFORMATION AND CONSENT FORM	77
LAMPIRAN 2 - BORANG KEIZINAN PESAKIT DAN JURURAWAT	78
APPENDIX 3 – QUESTIONNAIRE ON MIDWIVES’ AND NURSES’ KNOWLEDGE AND CONFIDENCE LEVEL IN RELATIONTO OBESITY AND ADIPONECTIN IN EARLY PREGNANCY IN HOSPITAL UNIVERSITI SAINS MALAYSIA (HUSM): A COMPARATIVE STUDY	79
LAMPIRAN 3 – SOAL SELIDIK TAHAP PENGETAHUAN DAN KEYAKINAN ANTARA BIDAN DAN JURURAWAT TENTANG HUBUNG KAIT ANTARA OBESITI DENGAN PARAS ADIPONEKTIN PADA AWAL KEHAMILAN: KAJIAN PERBANDINGAN.....	82

APPENDIX 4- ETHICAL APPROVAL LETTER.....	85
APPENDIX 5- HOSPITAL APPROVAL LETTER.....	89
APPENDIX 6 – POWER AND SAMPLE SIZE CALCULATION.....	91

LIST OF TABLES AND FIGURES

Table 4.1	Socio-demographic characteristics among nursing staffs	41
Table 4.2	Knowledge score result among nursing staffs	44
Table 4.3	Confidence level of nursing staffs in providing care and health education	47
Table 4.4	Factors that affecting the knowledge score of the nursing staffs on relation of adiponectin and obesity	50
Table 4.5	Association of knowledge level of the nursing staffs on relation of adiponectin and obesity with confidence level	51
Figure 2.1	Obese pregnant women and obese primigravida women in Hospital Universiti Sains Malaysia (HUSM) in year 2004-2009	13
Figure 3.1	Flow chart of data collection	38
Figure 4.1	Ratio nursing staffs in maternity unit, HUSM (n=91)	41
Figure 4.2	Highest level of education among nursing staffs (n=91)	42
Figure 4.3	Working experience of nursing staffs in maternity unit (n=91)	42
Figure 4.4	Knowledge score on relation of adiponectin and obesity among nursing staffs in maternity unit	45
Figure 4.5	Confidence level of nursing staffs in providing care and health education (n=91)	48

ABBREVIATION

BMI	-	Body mass index
DM	-	Diabetes mellitus
GDM	-	Gestational diabetes mellitus
G6Pase		Glucose-6-phosphate
LGA	-	Large for gestational age
LMP	-	Last menstrual period
NICU	-	Neonatal intensive care unit
OGTT	-	Oral Glucose Tolerance Test
PE	-	Pre-eclampsia
PEPCK	-	Gluconeogenic enzymes phosphoenolpyruvate carboxykinase
RM	-	Registered midwife
RN	-	Registered nurse

MIDWIVES' AND NURSES' KNOWLEDGE AND CONFIDENCE LEVEL IN RELATION TO OBESITY AND ADIPONECTIN IN EARLY PREGNANCY IN HOSPITAL UNIVERSITI SAINS MALAYSIA (HUSM): A COMPARATIVE STUDY

ABSTRACT

Adiponectin have been implicated in both the physiological adaptation to pregnancy and obstetrical complications while low plasma adiponectin has been identified as a risk factor for type 2 diabetes. Knowledge on adiponectin level and its association with obesity and gestational diabetes mellitus are important in obstetric care. To the researcher knowledge, there have been no published studies paid to explore midwives' and nurses' knowledge and confidence level in relation to obesity and adiponectin in early pregnancy in Malaysia. The aim of this study was to explore the midwives' knowledge and confidence level in relation to obesity and adiponectin in early pregnancy in maternity units, Hospital Universiti Sains Malaysia (HUSM) and to compare with that of nurses working in the same maternity units. A cross sectional survey on all nursing staffs (nurses and midwives) (n=91) in maternity unit HUSM was done using a self-administered structured questionnaire. Data was analyzed using the Statistical Package Social Science (SPSS) software version 18.0. Sixty-seven were midwives (74%) and 24 were nurses (26%). All nurses and midwives in maternity unit agreed that obesity increase the adverse health outcome to pregnant women. Independent t-Test revealed that midwives were more knowledgeable on relation of adiponectin and obesity in early pregnancy, with a mean score of 9.9, compared to nurses, with mean scores of 6.58 ($p < 0.05$). Using the One-way ANOVA test, the result also shown that the nursing staffs who have higher working experience have higher knowledge score (11.67) on relation of adiponectin and obesity, compared to nursing staffs who have less working experience ($p < 0.05$). There is no association between knowledge score of the nursing staffs in maternity unit with their confidence level in providing care and health teaching ($R^2 = 0.032$, $p > 0.05$). Majority of the nursing staffs (82.4%) in maternity unit addressed the need

of education regarding the relationships between adiponectin and pregnancy. A majority of the nursing staffs (more than 50%) disagree that they have sufficient knowledge regarding the relationships between plasma adiponectin with pregnancy and maternal overweight. This study suggests that the nurses, as compared to midwives, who are also front line healthcare providers lack adiponectin knowledge that is essential for daily practice. This low knowledge may affect their confident level and care given to pregnant women. Although the midwives' knowledge remains relatively higher than nurses, this warrants a need to promote adiponectin knowledge in relation to obesity and early pregnancy among nurses and midwives. Therefore, review should be made in the nursing and midwifery curricula. The results of this study herein presented can serve as the basis to facilitate continuous education and research on adiponectin and its association to obesity and in early pregnancy among other healthcare professionals.

Satu Penyelidikan Perbandingan Tahap Pengetahuan dan Keyakinan antara Bidan dan Jururawat tentang Hubung Kait antara Obesiti dengan Adiponektin pada Awal Kehamilan di Hospital Universiti Sains Malaysia (HUSM)

ABSTRAK

Adiponektin terlibat dalam adaptasi fisiologi terhadap kehamilan dan komplikasi terhadap kandungan sedangkan adiponektin plasma yang rendah telah dikenalpasti sebagai faktor risiko penyakit diabetes jenis 2. Pengetahuan tentang kadar adiponektin dan hubungan obesiti dengan diabetes mellitus semasa kehamilan penting dalam perkhidmatan kebidanan. Pada pengetahuan penyelidik, belum ada kajian yang diterbitkan dijalankan untuk menerokai pengetahuan dan tahap keyakinan diri bidan dan jururawat dalam kaitannya dengan obesiti dan adiponektin pada awal kehamilan. Tujuan kajian ini adalah untuk menjelajah pengetahuan serta tahap keyakinan diri pada bidan dan jururawat dalam kaitannya dengan obesiti dan adiponektin pada awal kehamilan di Hospital Universiti Sains Malaysia (HUSM) dan untuk membandingkan antara jururawat yang bekerja di unit bersalin yang sama. Satu tinjauan pada kakitangan kejururawatan (jururawat berdaftar dan jururawat berdaftar dengan kebidanan) (n=91) di unit bersalin HUSM dijalankan dengan soal-selidik. Data dianalisis dengan menggunakan Statistik Paket Sains Sosial (SPSS) versi software 18.0. Enam puluh tujuh orang bidan (67%) dan dua puluh empat orang jururawat berdaftar (26%) dari unit bersalin menyertai dalam kajian ini. Semua orang (100%) di unit bersalin bersetuju bahawa obesiti meningkatkan kesan kesihatan buruk terhadap wanita hamil. *Independent t-Test* menunjukkan bidan mempunyai lebih berpengetahuan pada hubungan adiponektin dan obesiti pada awal kehamilan, dengan min skor 9.9 berbanding dengan jururawat, dengan min skor 6.58 ($p<0.05$). *One-way ANOVA* menunjukkan bahawa kakitangan kejururawatan yang berpengalaman tinggi bekerja di unit bersalin mempunyai skor pengetahuan yang lebih tinggi (min=11.67) pada hubungan adiponektin dan obesiti berbanding dengan kakitangan kejururawatan lain ($p<0.05$). Tidak ada

hubungan antara skor pengetahuan kakitangan kejururawatan di unit bersalin dengan tahap keyakinan diri dalam pemberian rawatan dan pendidikan kesihatan ($R^2=0.032$, $p>0.05$). Kebanyakan kakitangan kejururawatan (82.4%) di unit bersalin bersetuju pendidikan tentang hubungan antara adiponektin dengan kehamilan diperlukan. Kebanyakan kakitangan kejururawatan (lebih daripada 50%) tidak bersetuju bahawa mereka mempunyai pengetahuan yang cukup mengenai hubungan antara adiponektin plasma dengan kehamilan dan kelebihan berat badan wanita hamil. Kajian ini menunjukkan bahawa kakitangan kejururawatan (bidan dan jururawat) yang merupakan pemberi kesihatan garis depan kurang pengetahuan adiponektin yang penting untuk amalan seharian. Pengetahuan yang rendah boleh mempengaruhi tahap keyakinan diri dan rawatan mereka kepada wanita hamil. Walaupun pengetahuan bidan tetap relatif lebih tinggi daripada jururawat, promosi peningkatan pengetahuan bidan dan jururawat pada adiponektin dalam kaitannya dengan obesiti dan awal kehamilan diperlukan. Oleh itu, tinjauan perlu dilakukan dalam kurikulum kejururawatan dan kebidanan. Keputusan kajian ini adalah sebagai asas untuk memudahkan pendidikan yang berterusan dan penelitian pada profesional kesihatan yang lain tentang adiponektin dan hubungannya dengan obesiti dan awal kehamilan.

DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

A handwritten signature in black ink, consisting of several overlapping loops and lines, positioned to the left of the date.

Date: 28-4-2011

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DEFINITION OF KEY TERMS

- Obesity** - BMI (body mass index) refers as an individual's weight in kilograms divided by the square of the individual's height in meters. Obesity is the BMI of the individual greater than or equal to 30kg/m^2 while overweight is the BMI of the individual between 25 and 30kg/m^2 (Kern, Di Greforio, Tong, Rassouli, & Ranganathan, 2003; Leddy, Power, & Schulkin, 2008).
- Adiponectin** - Adiponectin, adipoQ or adipocyte complement-related protein is a hormone expressed in adipose tissue (Greenberg, 2006). Adiponectin is an adipokine that has anti-diabetic, anti-atherogenic, anti-inflammatory and angiogenic properties. This adipocytokine can improve insulin action by improve glucose uptake by the skeletal muscle cells and reduce hepatic glucose production (Buras, Reenstra, Orlow, Horton, & Veves, 2005). This hormone has been implicated in both physiological adaptations to normal pregnancy and obstetrical complications.
- Pregnancy** - Pregnancy is a physiological state whereby a fertilized ovum will gradually becomes developed embryo within a female's ovary or womb and it lasts for about nine months which start from the date of the female's last menstrual period (LMP). Pregnancy can be indicated by positive results on an over-the-counter urine test, blood test, ultrasound, x-ray and others (Mosby, 2001)
- Knowledge** - Knowledge defined as the level or degree of information acquired in a particular field. It is a basic requirement so that the positive changes in behavior can be developed. Knowledge can further bring into awareness and in turn leads to action. In nursing, besides knowledge, clinical skills are also needed to care for patient. To develop nursing knowledge, it comes from both theoretical and practice perspectives. By gaining knowledge, it raises awareness of personal and professional accountability and the dilemmas of practice (Ndikom & Onibokun, 2007).
- Midwives** - Midwife is known as professional nurse who can provide advice, care and support for women and their families before, during and after childbirth include diagnose, monitor, provide health education, arrange parenting support, help in decision making about the services that they wish to access and others (Goldfield, 2010).
- Nurses** - Nursing is the art of utilizing the environment of the patient to assist him in his recovery (Nightingale, 1860-1969) while a nurse is the person who nursing people. Besides as a caregiver, nurse communicates with the client to identify the problem and helps them in learning about their health. Nurses also help in assisting client to make modifications in their behavior and promote personal growth (Berman, Snyder, Kozier, & Erb, 2008).

- Gestational Diabetes Mellitus (GDM)** - GDM defined as glucose intolerance of any degree that starts or is first recognized during pregnancy. This is caused by maternal tissue insulin resistance due to hormonal changes during pregnancy (Banhidly, Acs, Puho, & Czeizel, 2010).
- American College of Obstetricians and Gynecologist (ACOG)** - ACOG is an educational organization in United States. It composed of over 40,000 or 98% of the members are Obstetricians or Gynecologists. ACOG sponsors the publication of monthly journal entitled Obstetrics & Gynecology for educational document, current or emerging issues which help in education and evaluate the current health care practices (Honebrink, 2002).

CHAPTER 1 INTRODUCTION

1.1 Introduction

During the last decade, evidence has accumulated, demonstrating that adipose tissue is an important endocrine organ involved in metabolism and in pregnancy. Adipose tissue can exert its effects through several mechanisms, the most important of which is the secretion of bioactive mediators from adipocytes and other cells (Fuglsang, Skyærbaek, Frystyk, Flyvbjerg, & Ovesen, 2005). Since nurses and midwives are front line health care provider, a desire to explore the knowledge and confidence level of these health care providers provided the inspiration and determination for researcher to conduct the research study presented in this thesis. The introductory section of this thesis is followed by a presentation of background information on adiponectin, obesity and pregnancy. The rational of the study, problem statement, purpose and aims of the study, research questions, key word definitions, justification for, and significance of the study, are outlined and detailed. The thesis also comprised literature reviews; method and materials of the study; data analysis; discussion and conclusion.

1.2 Background of the Study

Adipose tissue secretes various hormones and cytokines, known as adipokines, which may be a connecting molecular link between adiposity and type 2 diabetes (Hotta, et al., 2000; Statnick, et al., 2000). According to Kadowaki et al. (2006), adiponectin, hormone secreted by the adipose tissue which had been reported to possess insulin-sensitizing properties play a role in metabolic syndrome. They also explained adiponectin is a 244-amino acid collagen-like protein (circulating protein) that is only produced by adipocytes.

Findings from animal studies and metabolic studies in humans suggest adiponectin may decrease the risk of type 2 diabetes, which act as suppression of hepatic gluconeogenesis; stimulation of fatty acid oxidation and insulin secretion in the liver; and stimulation glucose uptake in skeletal muscle. These effects may be partly mediated by stimulatory effects of adiponectin on signaling pathways for 5'adenosin monophosphate-activated protein kinase and peroxisome proliferator-activated receptor α (Kadowaki, et al., 2006; Rabe, Lehrke, Parhofer, & Broedl, 2008). Systemic review and meta analysis, which examined the prospective studies of the association of plasma adiponectin levels and risk of type 2 diabetes found that higher adiponectin levels are associated with a lower risk of type 2 diabetes across diverse populations, consistent with a dose-response relationship (Li, Shin, Ding, & Dam, 2009).

Adiponectin secretion, is paradoxically decreased in obesity (Hajer, Van Haeften, & Visseren, 2008) and body mass index (BMI) has constantly been associated with adverse health outcomes and, to a certain extent, adverse pregnancy outcome such as congenital malformations including anencephaly, spina bifida and congenital heart defects (Rosenberg, Garbers, & Chiasson, 2005).

Obesity is a rapidly growing worldwide health problem, conferring substantial excess risk for mortality and morbidity. In pregnancy, obesity appears to be a major contributing factor to medical risks such as gestational diabetes mellitus (GDM) (Martinez-Frias, et al., 2005). The increased risk of type 2 diabetes in obese individuals has been well established, and accumulating literature also supports the notion of a higher risk of gestational diabetes mellitus (GDM) associated with high BMI in prepregnancy and pregnancy stages. The combination of increased maternal adiposity and reduction in insulin sensitivity influenced by

hormonal products appears to be the causative factors in insulin resistance during gestational period (Chen, et al., 2006).

Serum adiponectin levels are inversely correlated with body mass index (BMI) and may be attributable to inhibition of adiponectin gene transcription by inflammatory and angiogenic factors secreted by hypertrophic adipocytes (Bruun, et al., 2003; Hajer, et al., 2008). The role for adiponectin in the development of insulin resistance has been implied in pregnancy.

Thus, adiponectin is a hormone that links adipose tissue and the whole body glucose metabolism. Adiponectin and resistin are adipokines that may be especially important in the relationship of excess adiposity to type 2 diabetes. Adiponectin is an insulin-sensitizing protein that circulates in oligomeric complexes, including trimers, hexamers and high-molecular-weight (HMW) multimers. In pregnant women, conflicting associations have been reported between maternal serum levels of total adiponectin (Ong, et al., 2007).

There is public expectation that nurses as front line health care providers are expected to be competent in their skills and knowledgeable in nursing. Adiponectin knowledge and its association with obesity and GDM are important and can provide appropriate screening recommendations to the antenatal population with a high risk profile. However, far too little attention has been paid to describe and or to explore nurses' knowledge on plasma adiponectin and obesity related domains effect on adiponectin in early pregnancy.

1.3 Rationale for the Study

Obesity is the epidemic of the 21st century, especially in developing countries. During the last decade, evidence has accumulated that obesity occurred at younger age and the prevalence of obesity continues to increase in an alarming rate. There are 20.9% of adults which include women in their reproductive age classified as obese in United State in year 2001 while adipokines that act in an autocrine, paracrine, or endocrine fashion was indicated to control different metabolic functions (Greenberg, 2006).

Obesity during pregnancy period increases the two most common medical risks mainly diabetes and hypertension. Because of its effect, it can endanger maternal and fetus health. According to Low, Tohit, Chong and Idris (2009), obesity correlated to low plasma adiponectin level which suggested to the development of metabolic disorder and other complications while increases the risk of complication during pregnancy period and risk of mortality and morbidity of maternal and fetus.

Himelfarb's (2004) study on improving health care providers' knowledge, attitude and practice found that general practitioners and nurses who have an increased level of knowledge and in their level of confidence lead to improved trust, better monitoring, and better adherence to new reproductive health guidelines. Because of the lack of knowledge and confidence in practice, this make prescribing treatment difficult and health care providers reluctant to diagnose, preferring instead to refer patients to a specialist.

The knowledge and confidence level of nurses towards childbearing women and obesity has been under scrutiny, with study indicating that understanding on impact of maternal obesity to health and health care delivery is lacking (Kirk, et al., 2009). This concurs with Knight,

Kurinczuk, Spark and Brocklehurst (2010) study that emphasized importance of surveillance and evidence to address primary prevention which guides appropriate management and service provision after the research.

1.4 Problem Statement

According to Ahire (2009), obese pregnant women have an increased incidence of pregnancy complication such as gestational diabetes and preeclampsia. Its effect can cause fetal over growth and an increase in the rate of traumatic birth injuries while child bearing women are prone to develop obesity, diabetes and hypertension in later of life. Health care providers' knowledge and confident is essential in providing reproductive health and surveillance of pregnant women. Therefore, it is imperative for nurses and midwives to acquire knowledge and confident in providing care for childbearing women (Himelfarb, 2004).

Because of obesity cause various complications to the childbearing women as well as to the fetus, this study can help in gaining the insight of nurses and midwives' knowledge and confidence level in regards to the domains of adiponectin, obesity and pregnancy. The outcome of this study can help addressed the issue of caring for obese childbearing women and provide the necessary information while meeting the challenges associated with providing health education and advice to these women.

In this research, the appropriate theory used is theoretical concept: the 'concept of knowledge and confidence level' by Michel Foucault.

1.5 Purpose of the Study

The ultimate purpose of this study is to gain the insight of the nurses and midwives' knowledge and confidence level regarding the relation between the obesity and adiponectin level during pregnancy. The study is to improve the quality of care provided by nurses and midwives to childbearing obese women and women during their pregnancy period. This research study can contribute to the body of knowledge on this issue. This study will provide an important baseline to guide the health care professionals, particularly the nurses and midwives who work in the maternity facilities to manage and provide care for obese pregnant women and also to childbearing women.

1.6 Aims of the Study

The researcher conducted a literature review which examined current research studies Malaysia and from around the world into the knowledge and confidence level of nurses and midwives towards caring for obese women during their pregnancy period. Significantly, no study was found concerning local and international nurses and midwives. Without current Malaysian research, the knowledge and confidence level of local nurses and midwives towards caring for obese women during pregnancy period cannot be accurately assessed. Information from this study can provide valuable input into assessing the efficacy of current nursing and or midwifery educational programs and the development of relevant programs in the future.

1.6.1 General Objective

The general aim of this study is to determine and to evaluate the knowledge and confidence level between the nurses and midwives on obesity and adiponectin level in early pregnancy in Hospital Universiti Sains Malaysia (HUSM).

1.6.2 Specific Objectives

- To determine the mean difference of knowledge score on plasma adiponectin in related to obesity in early pregnancy between the nurses and midwives
- To determine the confidence level of nurses and midwives in relationship to their knowledge on adiponectin and maternal overweight
- To identify the mean difference of knowledge score on plasma adiponectin between the nurses' and midwives' working experience

1.7 Research Questions

- What is the knowledge on plasma adiponectin in relation to obesity, maternal overweight, the risk related to adiponectin level in early pregnancy between the midwives and nurses?
- What is the confidence level of midwives and nurses in relationships to their knowledge on adiponectin, obesity, maternal overweight, the risk related to adiponectin level in early pregnancy?
- What is the mean difference of knowledge score on adiponectin between the nurses' and midwives' working experience?

1.8 Research Hypothesis

- There is association of knowledge score on plasma adiponectin in relation to obesity in early pregnancy between midwives (RNs with midwifery div. 1) and nurses (RNs)($H_0 \neq H_A$)
- There is association of knowledge score of nursing staffs between working experience in maternity unit ($H_0 \neq H_A$)
- There is association of confidence level in manage obese pregnant women with knowledge score of nursing staffs ($H_0 \neq H_A$)

1.9 Justification for, and Significance of the Study

The increased risk of type 2 diabetes in obese individuals has been well established, and accumulating literature also supports the notion of a higher risk of gestational diabetes mellitus (GDM) associated with high BMI in pre-pregnancy and pregnancy stages. The combination of increased maternal adiposity and reduction in insulin sensitivity influenced by hormonal products appears to be the causative factors in insulin resistance during gestational period. Serum adiponectin levels are inversely correlated with body mass index (BMI) and may be attributable to inhibition of adiponectin gene transcription by inflammatory and angiogenic factors secreted by hypertrophic adipocytes (Bruun, et al., 2003; Hajer, et al., 2008).

The role for adiponectin in the development of insulin resistance has been implied in pregnancy. The combination of increased maternal adiposity and the effects of insulin-desensitizing by hormonal products have been well established, and accumulating literature supports the notion that decreased level of adiponectin contributed to insulin resistance

during gestational period (Chen, et al., 2006). In pregnant women, conflicting associations have been reported between maternal serum levels of total adiponectin (Ong, et al., 2007).

In Malaysia, besides doctors, nurses and midwives contribute large proportion of the health care workforce especially in maternity unit. It is imperative that they are knowledgeable and competent to provide the highest quality of care to address primary prevention that emphasized importance of knowledge and self-confidence in improving health, knowledge and confidence is necessary (Kirk, et al., 2009).

To be safe healthcare professional, their initial nursing and midwifery education must be sufficient to assure their competence to practice on entry to their professions of nursing and midwifery, and the foundation has been laid for them to continue to learn throughout their professional lives. There is public expectation that nurses are expected to be competent in their skills and knowledgeable in nursing and midwifery; and confidence when providing care to patients.

Adiponectin knowledge and its association with obesity and GDM are important and can provide appropriate screening recommendations to the antenatal population with a high risk profile. However, far too little attention has been paid to describe the relation between normal and obese primigravida womens' body mass index (BMI) with plasma adiponectin levels and to explore nurses' and midwives' knowledge on plasma adiponectin and in relation to obesity and in early pregnancy.

The purpose of this study is to evaluate the knowledge of nurses and midwives that the adiposity is related to the adiponectin level measured in early pregnancy. The researcher also hopes that this finding of relationship can help in build up the preventive strategies

against the pregnancy complications like gestational diabetes, preeclampsia, fetal overgrowth and others.

Through this study, researcher hope to increase the awareness of the nurses and midwives who work in maternity area about the obese pregnant women and the future mother about the physiological health impact of body fat, and perhaps can take appropriate action to maintain ideal weight in their pregnant life. Thus, as health care providers, they can plan appropriate care and best practice to maximize the quality of life of childbearing women during the pregnancy period. Then, the pregnant women will be more aware to the issue on adiponectin in relation to obesity and pregnancy domain while helping the mother to maintain an ideal weight during the whole pregnancy period and after childbirth.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The 'ultimate goal of research is to develop, refine, and expand a body of knowledge' (Polit & Beck, 2004). It is necessary to conduct a review of the literature on the topic to allow the researcher to become familiar with the current body of knowledge on the topic before undertaking the research. It is because these reviews will provide a 'comprehensive understanding of the topic which help the researcher to be more aware of what is known and what questions need to be answered' (Gorard, Roberts, & Taylor, 2004).

As discussed in the introductory chapter of this thesis, there has been considerable scrutiny of health care providers' knowledge, attitude and practice towards caring for patient (Himelfarb, 2004). The purpose of this literature review is to explore the research literature on the knowledge, attitudes and practices; including confidence level that nurses and midwives have on adiponectin and towards caring for obese pregnant women in early pregnancy.

The remaining sections of this literature review presented the incidence and prevalence of obesity especially in the pregnant women, the relationship of obesity and adiponectin level in obese pregnant women, and the risk of low adiponectin level during the pregnancy.

2.2 Incidence and Prevalence of Obesity

Incidence of obesity increasing continuously in worldwide and it associated with metabolic disturbances which highlights a loss of control in homeostatic system (Mitchell, Armstrong, Robker, & Norman, 2005). According to Steffens and Mach (2008), excess adipose tissue

mass is related to cardiovascular morbidity and mortality. It contributes to atherosclerosis, hypercholesterolemia, inflammation and others. Guideline of Maternal and Child Enquiries and the Royal College of Obstetricians and Gynecologists stated that obesity in pregnancy defined as Body Mass Index (BMI) of 30 kg/m² or more at the first antenatal consultation has become one of the most commonly occurring risk factors in obstetric practice.

In England, the prevalence of obesity in the general population increased markedly in early 1990s while the prevalence of obesity in pregnancy has been increase from 9-10% in early 1990s to 16-19% in the 2000s which contribute increasing maternal and perinatal morbidity. Weight control before and during women's reproductive years is an important intervention to modify obesity's adverse effects on pregnancy outcomes and offspring health (Kanagalingan, Forouhi, Greer, & Sattar, 2005). According to Guideline of Maternal and Child Enquiries and the Royal College of Obstetricians and Gynecologists, Confidential Enquiry into Maternal and Child Health's report on maternal deaths in the 2003-2005 triennium showed that 28% of mothers who died were obese.

According to Kirk et al. (2009), almost 25% of Canadians are classed as obese and the obese rate almost doubled among the group of women aged 25-34 years that gives birth. Kirk et al. (2009) indicates that over 60 percent of the children from 1986 to 2004 were obese and obesity threatens the individual health and also weighs heavily on the health care system.

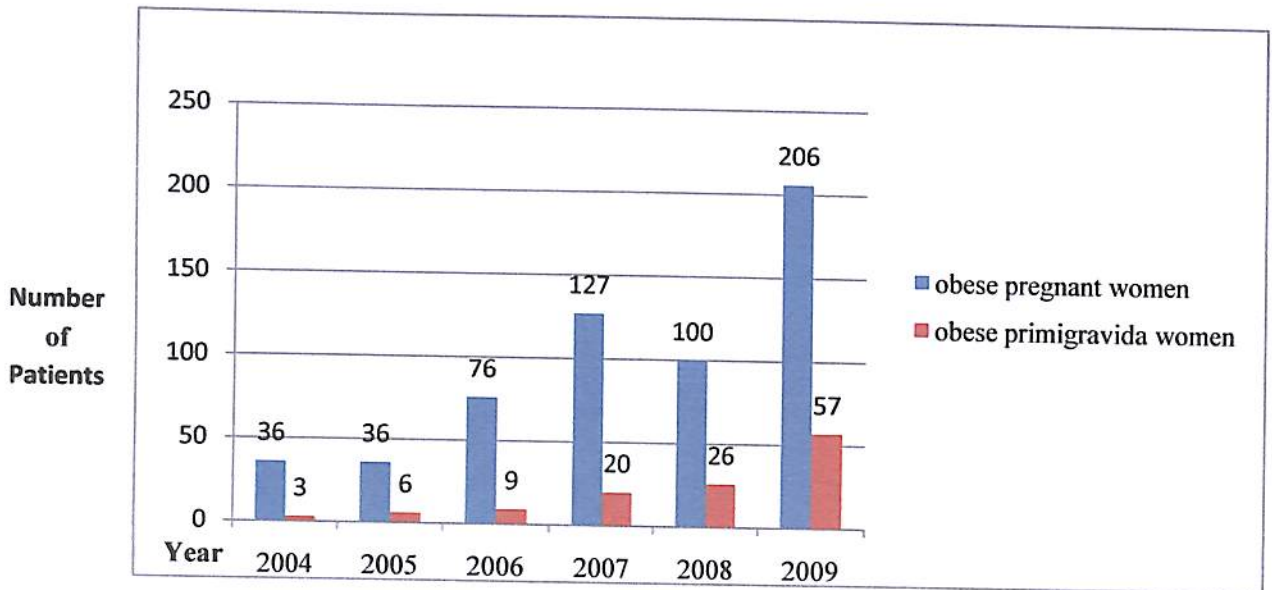


Figure 2.1: Obese pregnant women and obese primigravida women in Hospital Universiti Sains Malaysia (HUSM) in year 2004-2009

Source: Medical Record Unit, Hospital Universiti Sains Malaysia (2010)

Figure 2.1 showed that the record of years in the Hospital Universiti Sains Malaysia (HUSM). There are 36 obese pregnant women and 3 obese primigravida women in year 2004. In year 2005, there are 36 obese pregnant women and obese primigravida women have increase 2 folds to 6 people. In year 2006, the amount of obese pregnant women increases dramatically, which increase more than 2 folds while obese primigravida women increase 50% compared to year 2005.

From the data obtained from the Medical Record Unit, Hospital Universiti Sains Malaysia in 2010, the number of obese pregnant women has increased almost 2 folds than year 2006. In 2007, the total obese pregnant women are 127. The obese primigravida women of year 2007 increase more than 3 folds, with total number of 20 women. In year 2008, the obese pregnant women decrease to 100 people while obese primigravida women increased by 6 women. In year 2009, both data of obese pregnant women and obese primigravida women increase more than 2 folds than previous year. The total obese pregnant women are 206

people and total obese primigravida women are 57 people (Unit Record Perubatan HUSM, 2010).

2.3 Relationship of Obesity and Adiponectin Level

Adiponectin is a group of peptide and protein product of transcript 1 gene which synthesized abundantly, and exclusively, in adipocytes. This gene is located in chromosome 3q27 and is potentially link obesity to insulin resistance (Mazaki-Tovi, et al., 2009; Mitchell, et al., 2005). In healthy human, there is approximately 0.01% (5-10 μ g/ml) of all plasma protein while the adiponectin level is lower in the obese or overweight human (Tilg & Moschen, 2007).

Different studies have suggested that the obesity is an important risk factor for many chronic disease and cancers. An obese people who has low grade inflammation will contributes to pathogenesis of various chronic disease like cancer and metabolic syndrome such as insulin resistance and type-2 diabetes (Lee, et al., 2007). Studies in rhesus monkeys which provide good models of human obesity and type 2 diabetes had show that the adiponectin levels decrease in parallel with the prognosis of insulin resistance and type 2 diabetes (Hotta, et al., 2001).

Adiponectin also described as a work-house in keeping the heart healthy and helping in preventing the cardiovascular disease. It will protect the heart and blood vessels by stimulate the cellular responses ad inhibit the inflammatory activity thus decrease the risk of cardiovascular disease (Shibata, et al., 2004).

Function of adiponectin as insulin sensitizing agent can reduce the hepatic glucose production and enhance insulin action in liver. It will reduce the activity of gluconeogenic

enzymes phosphoenolpyruvate carboxykinase (PEPCK), glucose-6-phosphate (G6Pase), and reduce the fatty acid oxidation in hepatic system (Mitchell, et al., 2005).

According to Steffens and Mach (2008) and Mazoki-Tovi, et al, (2009), adiponectin also mediates antiatherogenic, angiogenic and antithrombotic effect through direct protective action on endothelial cells, smooth muscle cells, macrophages, and platelets. From the study of Karaduman, et al. (2007), they explained that the adiponectin involves in the activation of members of the caspase group of apoptotic enzyme which can suppress the angiogenesis. Different studies also showed that it will determine in the pathogenesis of atherosclerosis by inhibit the vascular smooth muscle and endothelial cell to proliferate.

Obesity has significant consequences for the reproductive system. It will contribute to menstrual disorders and infertility in young women (Mitchell, et al., 2005). Various study also found out that infertile or sub-fertile population are obese or overweight with reproductive complications including menstrual dysfunction, anovulation and miscarriage which further increase the mortality and morbidity of the women and fetus.

According to study by Liu, et al. (2006), adiponectin play role in delicately balanced system of energy homeostasis which involved the food intake and catabolism of carbohydrate and lipid. Low level of adiponectin can be found in men, obese people, diabetics and those with coronary artery disease which showed that the obesity has negative association with the adiponectin level. They also found out that higher level of adiponectin can be found in women, body weight reduction, chronic caloric restriction, and enhance sensitivity. From this study, the prevention and precaution stages can be taken in order to maintain an optimal level of adiponectin.

2.4 Risk of Low Adiponectin Level in Pregnancy

2.4.1 Breast Cancer

Breast cancer is the most common malignancy in women in developed countries where there are 178480 new cases of breast cancer were diagnosed in United States in year 2007 which associated with the obesity level in the country(Barclay, 2008). Different studies had been showed that decrease in weight may lead to decrease in risk for breast cancer. This is because the adiponectin has the potential role in regulating the tumor necrosis factor (Kaklamani, et al., 2006).

The essential for breast cancer development is the angiogenesis. By decreasing the level of adiponectin, it will increase the mitogenic effect of hyperinsulinemia and increased the IGF-1 and estrogen level (Karaduman, et al., 2007). Hyperinsulinemia may up-regulate the expression of vascular endothelial growth factor, a potent angiogenic agent which is secreted by breast cancer cell and further increase the risk of breast cancer among the women with low adiponectin level (Mantzoros, et al., 2004).

According to Tian, et al. (2007), obesity-related elevations in estrogens have been associated with increased the breast cancer risk where adiponectin has been inversely associated with estrogen levels and it may influence breast cancer risk. Form the Petridou, et al. (2003), they reported that the adiponectin levels are decreased in the premenopausal women with endometrial cancer and breast cancer which can explained that the low adiponectin level increased the risk of cancer.

Besides that, it will increase the risk of other obesity-related malignancies, including endometrial cancer, colon cancer, leukemia and others. From the study, it shows that

adiponectin potently inhibits the endothelial cell proliferation and migration which can leads to cell death. Treatment with adiponectin is able to modulate apoptosis of human breast cancer cell in vitro (Korner, Kratzsch, & Kiess, 2006).

2.4.2 Pyelonephritis

During pregnancy, a woman is more susceptible to infection especially of the lower urinary tract than the non-pregnant women like pyelonephritis. Pyelonephritis is a relatively common disease that will affect 1-2% of the pregnant women. This condition mostly can occur during the second and third trimester of pregnancy, and or during the postpartum period (Mazaki-Tovi, et al., 2010).

According to Mazaki-Tovi et al. (2010), they explained the role of adiponectin as an anti-inflammatory in pyelonephritis. They stated that adiponectin plays a role in innate immune response against intra-amniotic infection or inflammation in pregnant women. For those pregnant women with low adiponectin level, the role of adiponectin is being suppressed and it increased the risk of developing sepsis and other infection to themselves. It will further increase the risk of develop adult respiratory distress syndrome (ARDS) which increase morbidity and mortality rate of mothers.

2.4.3 Metabolic Syndrome

Metabolic syndrome (MS) includes hypertension, insulin resistance, glucose intolerance and dyslipidemia which associated with obesity. Low adiponectin level also associated with the MS and its cardiovascular consequences because adiponectin play role as vasoprotective

and anti-inflammatory property. It is because adiponectin was recognized that the protein had sequence and/or structural homology to immune proteins such as complement and TNF- α which play role in inflammation (Whitehead, Richards, Hickman, Macdonald, & Prins, 2005).

According to Santaniemi, Kesaniemi and Ukkola (2006), many studies had stated that hypoadiponectinemia is associated with the risk of MS and measurement of the adiponectin level becomes a useful biomarker for the management in MS. Besides that, this study also provides the information that the adiponectin regulates the hepatic lipase activity which low adiponectin level will increase the level of plasma triglycerides and decrease the HDL-cholesterol.

In study of Matsuzawa, Funahashi, Kihara and Shimomura (2004), they found out that high-fat or high-sucrose diet to mouse elevate the plasma glucose and plasma insulin level. When provide the adiponectin supplement to the mouse which injured the aorta, it increased intimal smooth muscle cell proliferation which suggest that the high adiponectin level can be used in prevent against vascular remodeling during endothelial injury. From this study, we can also determine that diet can play an important role in regulate the adiponectin level to reduce the risk of develop metabolic syndrome.

2.4.4 Gestational Diabetes Mellitus (GDM)

Gestational diabetes mellitus develops as consequences of the lack of physiological compensation of insulin resistance accompanying every pregnancy, which leads to hyperglycemia in the pregnant woman and a number of metabolic complications in the fetus which include the perinatal mortality, shoulder dystoria, jaundice and others (Mumtaz, 2000). According to Knight, et al. (2010), 11% of extremely obese women were diagnosed as

gestational diabetes and found out that adiponectin plays a role of insulin-sensitizing property.

Low, Tohit, Chong and Idris (2009) stated that the single nucleotide polymorphism (SNP) 45 is the adiponectin gene that associated with obesity and other insulin resistance syndrome. TG/GG genotype in adiponectin SNP 45 showed in gestational diabetic patient shows that the gene lower the adiponectin level and increase the risk of GDM. This evidence help in detect the obesity have a higher risk to develop insulin resistance syndrome.

Tsai, et al. (2005) stated that development of pregnancy-induced insulin resistance or called as gestational diabetes is associated with maternal obesity. Obesity increased maternal diabetogenic hormones like progesterone, cortisol and others. Increased plasma free fatty acid which can decrease insulin-sensitivity and increase the risk of develop gestational diabetes and future diabetes in pregnant women.

According to Guelinckx, Devlieger, Beckers and Vansant (2008), gestational diabetes increases the risk of fetal macrosomia where the birth weight of the fetus is more than 4.5kg at any gestational age. Low level of adiponectin also predicts the risk of developing different type of diabetes later in life. According to Nien, et al. (2007), they tested on animals and had found out that administration of adiponectin can improve the glucose tolerance and insulin sensitivity which may can used in human subjects in order to increase the adiponectin level and prevent risk of gestational diabetes in pregnant women.

2.4.5 Preeclampsia (PE)

Preeclampsia is known as the blood pressure equal as or higher than 140/90 mmHg with proteinuria of either higher than 100mg/dl by urine analysis or higher than 300mg in a 24 hours urine collection. It is a pregnant specific syndrome which can lead to maternal and perinatal morbidity and mortality. This characteristic mostly will be presented by onset of hypertension and proteinuria after 20 weeks of gestation in a previously normotensive pregnant woman (Khosrowbeygi & Ahmadvand, 2009).

According to the Becker, Verneulen, Wyatt, Meier and Ray (2007), there is a strong association between maternal weight in early pregnancy and higher risk of pre-eclampsia with odd ratio for pre-eclampsia. According to Ramsay and Greer (2004), the study stated that high body mass index (BMI) and insulin resistance in pregnant women are more likely to develop preeclampsia (PE) where preeclampsia is characterized by widespread endothelial damage and dysfunction throughout the maternal circulation.

Frederick, Rudra, Miller, Foster, and Willians (2006) found that increase in the pre-pregnancy BMI will increase 8% of preeclampsia in every unit increase of the BMI. Fasshauer, Walderyer, et al. (2008) highlighted that PE increased future metabolic and cardiovascular risk for the pregnant woman and also the fetus; and hence cause vasoconstriction of the circulation system and intrauterine growth restriction. The result is preterm delivery and low birth weight in fetus. It also suggested that prospective studies should be done to determine plasma adiponectin determination in early pregnancy might improve prediction of PE and reduce the mortality and morbidity rate on mothers and fetus.

2.4.6 Large-for-gestational Ages Infant

Large-for-gestational infant also defined as an infant which birth weight greater than 90th percentile. Fetal growth is determined by nutrient transferred across the placenta from mother and maternal hormones like insulin, leptin and others. Large-for-gestational ages infant increase the risk of traumatic birth injuries. This is due to the maternal hyperinsulinemia and increased the fat accumulation in the infant. Besides that, they are also prone to develop obesity, diabetes, and hypertension in future due to they also have low adiponectin level in the body which regulate the insulin and other hormones (Jansson, et al., 2008).

According to animal experiment, it suggests that the regulation by changes in maternal dietary intake will regulate the placental transport capacity by maternal hormones which altered the fetal growth (Jansson, et al., 2006). From this study, we will become clearer that the changes in diet intake will help in decrease the rate of large-for-gestational ages infant which further can decrease the risk of morbidity and mortality between mother and infant. As a health care provider, we must have the knowledge between the influence of obesity and adiponectin level in order to provide effective health teaching to the mother who is obese and prone to develop this kind of risk.

2.5 Adiponectin and Increased Risk for Adverse Outcomes of Pregnancy, Delivery and Birth

2.5.1 Increased maternal risk

GDM is associated with hypertensive disorders (Leddy, et al., 2008) with increased risk of preeclampsia debuting in preterm pregnancy (Galerneau & Inzucchi, 2004). Women with

GDM are more likely to be delivered by caesarean section and to be exposed to induced labour (McLaughlin, Cheng, & Caughey, 2006). Pregnant obese women with insulin treated GDM and poor glycemic control develop significantly more often preeclampsia compared to pregnant obese women with well controlled insulin treated GDM. The prevalence of chronic hypertension was increased 2- to 3-fold in overweight and obese women with GDM regardless the treatment of GDM or the level of glycemic control (Leddy, et al., 2008).

2.5.2 Increased fetal risk

The presence of GDM during pregnancy may affect the outcome of the newborn child. A higher proportion of children are born with macrosomia (Dixit & Girling, 2008), dystocia is more common (Porte, Sherwin, Baron, Ellenberg, & Rifkin, 2003), and preterm birth is more prevalent in cases of GDM even when the condition is being treated (Yogev & Langer, 2007). The newborn infants are affected with hypoglycaemia more frequently (Jovanovic, 2001) and are in need of care in neonatal intensive care units (NICU) to a larger extent (Galerneau & Inzucchi, 2004).

There is no increased risks of congenital malformations have been revealed when GDM is detected during the third trimester (Fraser & Heller, 2007). However, it has been reported that some specific malformations are more frequent among infant of women with GDM, such as specific cardiac defects, oesophageal/intestinal atresia and spinal deformations (Banhidy, et al., 2010).

A randomized clinical trial investigating whether treatment of women with GDM would reduce the risk of perinatal complications demonstrates significantly lower rates of serious perinatal complications such as perinatal death, shoulder dystocia, bone fracture and nerve

palsy in the intervention group. Furthermore, the intervention group gave birth to significantly fewer large for gestational age (LGA) infants and significantly fewer infants had a birth weight of 4 kg or more (Guelinckx, et al., 2008).

Regardless of glycemic control, overweight and obese women with diet treated GDM and poorly controlled insulin treated GDM were at 2 to 3-folded increased risk of giving birth to a LGA child, whereas women with well controlled insulin treated GDM gave birth to LGA infants to the same extent as women in all BMI groups (Yogev & Langer, 2007).

2.5.3 Future health risks for the woman: Diabetes mellitus type 2 (DM2)

Following the pregnancy, the risk of development of DM2 is increased. Because of this future health risk for the woman, the main focus of clinical health care postpartum should aim to reduce the risk of DM development (Bentley-Lewis, Levkoff, Stuebe, & Seely, 2008). The cumulative incidence of DM2 varies from 2.6% to over 70% at 6 weeks to 28 years post partum in women with prior GDM (Kim, Newton, & Knopp, 2002). This cumulative incidence increases rapidly over the first five years and thereafter seems to reach a plateau ten years after the index pregnancy. Elevated fasting glucose levels during pregnancy are the best predictor of future DM2 (Retnakaran, et al., 2008).

In a recent review and meta-synthesis study, the relative risk of developing DM2 after a pregnancy with GDM was more than a 7-folded compared to women with a normoglycemic pregnancy (Persson, Winkvist, & Mogren, 2009). In Denmark, 40% of women with prior GDM develop DM within ten years from the index pregnancy, an incidence that is increasing over time probably due to a parallel increase of obesity among women (Lauenborg, et al., 2004).

In Sweden, 35% of women with prior GDM are diagnosed with DM2 15 years after the index pregnancy (Linne, 2004). Some women with GDM are at increased risk of developing diabetes mellitus type 1 (DM1) after pregnancy. In a Swedish follow-up study, 6% of women with prior GDM had β -cell-specific autoantibody markers. Of those autoantibody-positive women 50% had developed DM1 after the pregnancy compared to none of the GDM reference group (Nilsson, Ursing, Torn, Aberg, & MLandin-Olsson, 2007).

In USA, the ADA recommends measurements of fasting glucose in the immediate postpartum period in order to identify women with persisting hyperglycaemia after childbirth. When normal blood glucose levels in the immediate postpartum period are observed, an OGTT is recommended some time during the first two to six months postpartum. If the second measurement postpartum is normal, the American Diabetes Association (ADA) recommends annual testing for diabetes mellitus. However, they found that only a third of the women underwent the recommended screening (ADA, 2007).

In Sweden, there is no unified recommendation for the performance of the GDM follow-up postpartum; however, in the majority of the local clinical guidelines, a follow-up including an OGTT is recommended within the first year postpartum (Smirnakis, et al., 2005). In a Swedish study, women developing DM2 after child birth gain significantly more weight after their pregnancy resulting in their first child in relation to women who do not develop DM. It is important to notice that Swedish women tend to regard GDM as an incentive to improve their life style in order to prevent future DM (Linne, 2004).