

**A Modified Systematic Review and General Literature Review of  
Overweight and Obesity among Pregnant Women in the Arab  
Gulf Countries**

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# **Chapter One: Executive Summary**

Obesity trends are on the rise globally and are creating health complications both to individuals and health systems. This dissertation will investigate obesity issues with a specific focus on pregnant women in the Gulf countries. The modified systematic review will involve searches of academic databases and official websites. Due to the paucity of literature specific to Gulf countries, literature in the Western contexts will also be sought and such findings will be used for the transfer of knowledge from different contexts to the Gulf context. The role of social determinants will be considered in relation to obesity among women during pregnancy. Based on the modified systematic review and the general literature review, the study will make recommendations specific to the issue among pregnant women in Gulf countries.

## **1.1 Purpose**

The purpose of this dissertation is to conduct a modified systematic review of the effects of weight gain and obesity on pregnancy outcomes particularly in relation to Gulf States women. In addition, it will evaluate possible risk factors for excessive weight during pregnancy, and consider options for intervention.

## **1.2 Significance of the Study**

For most of the 20<sup>th</sup> century the majority of studies on obesity have tended to focus on the developed world where there has been a major surge in the prevalence of obesity. However, current literature also points to this issue being prevalent in developing countries as well (Musaiger, Al-Awadi, & Al-Mannai, 2000; National Institute of Health Consensus Development Panel of the Health Implication of Obesity, 1985; Simpopoulos & Vanitallie, 1984). This dissertation will therefore add to the existing knowledge on the topic, specifically focusing on obesity in pregnant women. Furthermore, being in the era where there is increasing concern for childhood obesity, this study has implications for interventions as evidence indicates that there is a link between maternal obesity and childhood obesity.

## **1.3 Research Questions and Objectives**

Overall this dissertation aims to answer the following research questions.

1. What is the prevalence of obesity among pregnant women in Gulf countries?

2. What is the role of economic, social, behavioural, and lifestyle factors associated with obesity among pregnant women in Gulf countries?
3. What evidence is available about the pregnancy complications related to obesity among pregnant women?
4. What are the ways in which the identified issues could be addressed to reduce obesity and its complications for Arabian Gulf women?

## **1.4 Summary of the Methodology**

The methodology to be utilized in this research is a modified systematic and general literature review. The review has been modified because the traditional systematic literature reviews tends to review and utilize experimental studies while this study will not rely on these entirely. In order to answer the research questions, modifying the systematic review was necessary because there is a very little published literature that is specific to Gulf countries.

## **1.5 Outline of the Research**

This dissertation consists of five chapters, organized as follows:

- Chapter one outlines the purpose and significance of the study, the research questions, and summary of the research methodology.
- Chapter two gives a general overview and background to the research topic. This includes background information about Gulf countries including Saudi Arabia, Oman, Kuwait, Bahrain, the United Arab Emirates, and Qatar. The economic and social status of these countries will also be discussed.
- Chapter three discusses two methods. Firstly, the modified systematic review process is conducted to answers the first and second research questions. The second method, a general literature review, is conducted to answer the complication and the intervention sections (research question number three and four).
- Chapter four discusses the two findings of the research. It also discusses how the research questions have been addressed for selected studies and explains part of the scientific information about obesity and the pathophysiological aspects of obesity among pregnant women which includes complications that are related to the issue of obesity.
- Chapter five presents the overall discussion and conclusion of the dissertation as well as the recommendations for an evidence based intervention to reduce obesity among pregnant women in Arabian Gulf countries.

## Chapter Two: Introduction

To set the background, the study will begin by a review of the issue of obesity in general, including the definition and global trends of obesity. The dissertation will take a particular focus on issues related to obesity in Gulf countries. These issues will be researched in literature in the areas of gender, age and lifestyle. The role of social determinants will be considered in relation to obesity in the specific target group. The risk factors identified for this population group will be reviewed to act as a base line for proposing guidelines of interventions. Before taking a particular focus on the modified systematic review process, it is important to begin by investigating global trends of the obesity epidemic.

### 2.1 Definition of Obesity and Weight Gain

An individual's weight is formulated by the net result of the balance between energy intake and energy expenditure (Al-Nozha et al., 2005). When this balance is significantly out, the result is either underweight to malnourished, or, overweight to obese. Although controversial, the widely used method considered to be objective in classifying obesity is the Body Mass Index (BMI). The BMI is a medical standard ratio to determine healthy weight ranges for humans, specifically standards for obesity. A person's BMI is calculated by determining the weight in kilograms, then dividing it with the square of the height in meters. Medical guidelines have specified the range for a normal BMI to be between 18.5 – 24.9kg/m<sup>2</sup>, and overweight as being between 25.0 - 29.9 kg/m<sup>2</sup>. On the extreme end is the obese which is classified as over or equal to 30kg/m<sup>2</sup> (Ministry of Health, 2006).

Table (1) below summarizes the definitive zones:

Description	Measurements
Underweight	BMI < 18.5 kg/m <sup>2</sup>
Normal	BMI 18.5–24.9 kg/m <sup>2</sup>
Overweight	BMI 25–29.9 kg/m <sup>2</sup>
Obese	BMI ≥ 30 kg/m <sup>2</sup>

Although the above method is internationally acclaimed for use in measuring adiposity, its application to different countries should be viewed in context. That is, a consideration for factors such as body composition and fat distribution. For example, muscular individuals such as rugby players have often been misclassified as obese using the BMI formula (National Task Force on the Prevention and Treatment of Obesity, 2000).

## **2.2 Overview of Global Trends Related to Obesity**

Obesity trends are on the increase globally and creating avoidable health complications both to individuals and health systems. The world overweight population is comprised of more than one billion adults with 300 million classified as obese (World Health Organization, 2003). The rates of obesity have risen three-fold or more since 1980 in many areas of the world such as the United States, the United Kingdom, Eastern Europe, the Pacific Islands, Australasia and China. Other studies have pointed to the trends showing that the Middle East, Central and Eastern Europe, and North America are among the areas with the highest obesity prevalence rates (James, Leach, Kalamara, & Shayeghi, 2001).

Obesity is prevalent in both developed and developing countries and is not only a product of urbanized or industrial societies. It is increasing more rapidly in developing nations rather than the developed world (World Health Organization, 2003). In regards to this, James et al. (2001) found that obesity is often linked to poverty, even in developing countries, which is a reversal from findings of previous decades where obesity was related to wealth. Even in developing areas when obesity rates have been classified as comparatively low, it follows that as urbanization occurs, obesity will increase if current trends continue (Al-Nuaim, 1997).

Consistent with trends highlighted in developing societies globally, modernization is cited as being a key factor in the growing prevalence of obesity. This increase in the obesity epidemic has been caused by a combination of a number of complex factors which include changes in eating habits, lifestyle factors, work environments, socio-economic issues, urbanization, increasingly sedentary lifestyles and cultural issues. James, et al. (2001) notes that the adoption of an energy dense diet is attributed to the comparative low cost and prevalence of processed foods. In such options, energy is mainly sourced from sugars and fats instead of nutritionally richer complex carbohydrates and proteins. The latter is forming the basis of more traditional food options that are rapidly becoming a thing of the past. The over-supply of nutritionally poor foods is coupled with a westernized marketing strategy offering unnecessarily large meal portions and the immediacy of fast food options in a context where

time pressure is more pronounced (James et al., 2001). This growth pattern is presenting faster in developing countries than in the developed world (World Health Organization, 2003).

This increase in obesity has caused people significant ill-health by creating new health problems and worsening pre-existing conditions in patients in the strained health systems of the developing countries. Furthermore, this increase in obesity rates has not only put unnecessary risk on the wellbeing of affected individuals but also placed economic burdens on the already stressed health care systems globally (Almajwal, William, & Batterman, 2009; World Health Organization, 2003). The World Health Organization (2003) claims that obesity is accounted by 2% to 6% of total health care expenditures in quite a number of developed countries. However, the exact costs are without a doubt much larger since not all conditions related to obesity are incorporated in the estimations (World Health Organization, 2004). Furthermore, according to the World Health Organization (2003) obesity related health risks and complications may include serious diet-related chronic diseases; such as type II diabetes, hypertension and stroke, cardiovascular disease as well as some forms of cancer.

Globally, it has consistently been found that men have higher overweight rates than women (James et al., 2001). In addition, the adverse effects of obesity may be more severe for women than for men. For example, obesity has been found to be associated with developing asthma in women but not in men (Beckett, Jacobs, Yu, Iribarren, & Williams, 2001).

Western studies have indicated that minority women are particularly vulnerable to obesity (Flegal, Carroll, Ogden, & Johnson, 2002; Williamson, Kahn, Remington, & Anda, 1990). However, average estimates of weight retention associated with pregnancy are small, ranging from -0.27 kg to 3 kg (Gore, Brown & West, 2003). Although some researchers have attributed weight gain to physiological causes, such as delayed lacto genesis ("milk coming in") (Chapman and Perez-Escamilla, 1999) and lower prolactin response (Rasmussen & Kjolhede, 2004). However, as obese women are more likely to belong to subgroups of women with lower rates of breastfeeding than normal weight women, such as lower socioeconomic status (Rennie & Jebb, 2005) and higher depression (LaCoursiere, Baksh, Bloebaum, & Varnier, 2006), it is necessary to adjust for these potential confounding factors (Amir & Donath, 2007).

A recent document, the WHO consultation report on Obesity, has made special note of the increase in the rates of obesity among women all over the world. It is of concern that this epidemic is affecting women in all fertile ages (World Health Organization, 2003).

### 2.3 A Regional Focus: The Arab Gulf Countries

Gulf countries such as Saudi Arabia, Oman, Bahrain, Kuwait and the United Arab Emirates were selected because studies in these countries can be generalized due to their similar background and contexts. This is mainly because of relative similarities in economies, political systems, and most importantly cultural patterns and health care systems. However, it is acknowledged that these countries may have some differences too. Before embarking on the systematic review it is therefore important to provide brief background information about these countries. Political, social and economic similarities will also be discussed because they are also the aims of this study and these issues are social determinants of obesity prevalence (Al-Nuaim, 1997). The picture below shows the map of Arabian Gulf countries.



#### 2.3.1. Saudi Arabia

In geographical terms, the Kingdom of Saudi Arabia makes up four-fifths of the Arabian Peninsula, and the majority of the population 15.6 out of 20.8 million people are Saudis. In terms of higher rates of lifestyle diseases, the Eastern oil-producing region has the longest history of adopting the Western lifestyle, with respect to nutritional habits and exercise. On the other hand, the Northern region is known for its strong tribal lifestyle which is reflected in their attitudes and values (Al-Nuaim, Bamgboye, Al-Rubeaan, & Al-Mazrou, 1997).

The Kingdom of Saudi Arabia, as all other nations, due to tradition, historical and cultural factors as well as its geographical location, it has its own set of social determinants regarding the prevalence of obesity. As mentioned by Al-Nozha, Al-Mazrou et al, (2005) the Kingdom is dealing with trends associated with obesity due to recent and ongoing modernization. It is an accepted fact that urbanization has caused a more sedentary lifestyle and is a significant contributor to obesity (Al-Nozha et al., 2005).

Concerns about the rise of obesity related diseases have been cited in Saudi Arabia since 1990's including hypertension, osteoarthritis of the knee and a range of other functional disabilities have been noted to be on the rise because of this (Rasheed, 1998). Studies have indicated an alarming rate of obesity in the Kingdom of Saudi Arabia mainly among women (Al-Shammari, Khoja, Al-Maatouq, & Nuaim, 1993; Kissebah, Freedman, & Peiris, 1989; Michael & Jonathan, 1988; Millar & Stephens, 1987; Pi-Sunyer, 1991; Romano & Carlo, 1994; Seidell, 1995).

### **2.3.2 Kuwait**

Kuwait is one of the Gulf countries from which review articles were derived for this study. In geographical terms, this country is bordered by Saudi Arabia and Iraq. Kuwait had colonial links with the United Kingdom up to 1961 and this colonial history is important in tracking lifestyle in relation to westernization. Economic growth is driven mainly by the oil industry, which accounts for 95% of export revenues, and 80% of government income. While the economy produces positive attributes to the Kuwait population, it has been observed that the culture of affluence is marked with negative social determinants with regards to health, due to excessive sedentarism. This has seen 74.2% of adults aged 15 and above to become overweight, making the country the 8th fattest in the world (Abdulla, 2010).

### **2.3.3 Bahrain**

Another Arab Gulf country from which some of the study articles were derived in this research is Bahrain, which is made up of about thirty islands.

According to Bahrain's government website, there are three other factors that have been predicted to possibly lead to further impact in the adoption of the affluence culture. These include the growth of employment in recent years, the changing composition of Bahrain's export, the strength and composition of the small and medium enterprise sector in Bahrain as well as the performance of the tourism, banking and construction sectors during the global

downturn. A projected GDP growth over the next two decades could potentially imply further issues about the affluence culture (Abdulla, 2010).

### **2.3.4 Oman**

Another country which has some studies that have been carried out around this topic is Oman. Similar to Bahrain, Oman's economic performance increased tremendously in 1999 mainly due to the improvements in oil prices. Like Bahrain, Oman has a national road network which facilitates automobile movements and hence the lead to the adoption of sedentary lifestyles (Khanfar, 2010).

Another influence on the economy was a change in political ideology which marked the abolishment of the use of Oman ports for facilitating the transportation of slaves and arms of war. Although at one point Oman's economy was threatened by decline when its economy relied exclusively on agriculture, fishing, camel and goat herding, many liberal policies outweighed the negative forces on the economy. One of these was its policy on improving neighborhood relations that has helped maintain modernization with these neighbors. Other influences of affluence include commercial law to facilitate foreign investment and the liberalization of its markets as well as its ascension to the World Trade Organization in the year 2000 (Khanfar, 2010).

Another possible determinant in the obesity and overweight issue among women is the vision of the Oman government to undertake many development projects to modernize the economy, improve the standard of living, and become a more active player in the global marketplace. In the case where countries aim to join the global market, Western lifestyles tend to be adopted. There are a lot of conformity measures that get undertaken when a country joins the world market especially when the forces of globalization come into play (Khanfar, 2010).

The government's vision and embracement of westernization can even be deduced from the statement by the Oman head of state, which reads:

“I promise you to proceed forthwith in the process of creating a modern government. My first act will be the immediate abolition of all the unnecessary restrictions on your lives and activities..... I will proceed as quickly as possible to transform your life into a prosperous one with a bright future” (Khanfar, 2010, p. 1).

A positive factor, which might be considered in planning health promotion and intervention strategies, is the fact that further contribution towards adult education will arise in the form of the forthcoming establishment of the Oman Nursing Institute, which will have a capacity to teach 100,000 students. This might help in planning initiatives of education for pregnant women, the rationale being that it might be easier to teach educated people; and the nursing school will also help in the health promotion workforce (Khanfar, 2010).

### **2.3.5 The United Arab Emirates**

The United Arab Emirates (UAE) is one of the Gulf countries that has the majority of its 3.1 million population being expatriates because of its economic activities. This therefore means that only a small proportion of the population comprises of local citizens. The UAE went through a quick growth in the past 30 years after the discovery of oil and the formation of the country from the seven Emirates. A recent infrastructure has been constructed and people have had significant changes in the standard of living that associated with the rapid development of their country. The people of UAE have experienced a fast shift from deficiency related illnesses and undernourishment to degenerative illnesses linked with over nutrition (Carter, Saadi, Reed, & Dunn, 2004).

### **2.3.6 Qatar**

The Qatari peninsula juts 100 miles (161 km) north into the Arabian Gulf from Saudi Arabia and is slightly smaller than the state of Connecticut, USA. In recent years Qatar has placed great emphasis on education. Citizens are required to attend government-provided education from kindergarten through high school (Ministry of Foreign Affairs, 2011). Obesity in Qatar has become an important public health issue especially among women in 2000, when study showed that 62.6% of women were overweight or obese in Qatar (Musaiger, Al-Awadi, & Al-Mannai, 2000).

## **2.4 The Scope of the Obesity Epidemic in Arab Gulf Countries**

Bearing in mind the changing socio-economic context of the Gulf Countries, it is important to acknowledge and generate further knowledge of the impacts of obesity as a disease of affluence. This study therefore looks at the scope of the obesity epidemic as a disease of affluence in the Gulf States with the particular focus on pregnant women.

One of the contributors of the obesity epidemic in the Arabian Gulf countries, such as Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates is the rapid social and economic changes, noted mainly because of the oil boom period (i.e. 1973-1981) (Abdulla, 2010). This fast transformation in lifestyle which resulted from a boost in income has led to the increase of a paradoxical nutrition situation. Among the increasingly affluent residents, hypertension; obesity; non-insulin dependent diabetes; and coronary heart disease is evident; while citizens associated with underdevelopment, however are failed with growth retardation, nutritional and anaemia. Obviously, this situation imposes a big challenge to health authorities to conquer such problems and with the lack of a clear nutrition policy in all Gulf countries, the challenge turns out to be even greater (Musaiger, 1990).

On the one hand, these changes led to changes in the nutritional status of the population. One prominent change has been in the area of infant mortality. Infant mortality can be used as a standard of assessing the quality of a particular health system. In these countries, infant mortality and morbidity rates have decreased considerably and reached the same rate as that of the developed countries. For example, the infant mortality rate in Kuwait is 22/ 1000 live births, while the mortality rate in the under fives is 25/1000 live birth (Musaiger, 1990). However, Al Darmaki (as cited in Saberi, 2011) recently noted that the infant mortality in the UAE is less than 10 per 1,000 births, and the newborn death rate is less than 8 per 1,000 live births.

Cultural and economic factors have, however, contributed to sedentary life styles in the Arab Gulf countries (Al-jerdawy, 1986). For example, increased intake of energy-rich foods combined with lack of exercise could be a major cause for obesity among the Gulf women. In addition, for cultural reasons, a large number of women in this region are not working (ranged from 90% to 95%) and depend on foreign maids for house chores (Al-jerdawy, 1986). Without a doubt, this reduces their physical activity and thereby decreases the daily requirement of energy leading in turn to a buildup of fat in the body, even when the consumption of food is fairly low. This issue is exacerbated as Gulf and Arabian dishes in general are mainly rich in fat and energy (Musaiger & Sungpuag, 1985). Factors such as social surroundings and attitudes of the community are also associated with obesity among women in the Gulf Countries. Overweight mothers are at a higher risk for diabetes, coronary heart diseases, and hypertension. These medical conditions are considered to be the leading causes of fatality in the region. For instance, circulatory system diseases are accountable for over 30% of death in the Gulf countries (Musaiger, as cited in Musaiger, 1990). Table 2 below summarizes these findings.

Table (2): Obesity Prevalence in Arabian Gulf Countries.

References	Country	Age group (years)	Sample size	Prevalence of obesity (%)
Osman and Al-Nozha (2000)	Saudi Arabia	≥ 18	6,253	20.5
El-Hazmi and Warsy (2000)	Saudi Arabia	≥ 14	14,000	20.3
Musaiger and Al-Mannai (2001)	Bahrain	30-79	514	34.9
Carter et al. (2004)	United Arab Emirates	≥ 18	535 (all females)	35
Sorkhou et al. (2004)	Kuwait	≥ 40	250	46
Al-Nozha et al. (2005)	Saudi Arabia	30-70	17,232	35.6

\*Adapted from Al-Nozha et al,(2005)

## 2.5 Rationale for Focusing on Women in Gulf Countries

In line with global trends, the women in Arabian Gulf countries are more prone to obesity than men (Almajwal, William, & Batterman, 2009). A study in Saudi Arabia investigated a group of 1072 Saudi patients (595 women, 477 men) attending the primary health care at the centre of King Fahad Hospital, Al-Khobar (Al-Nozha et al., 2005). The study found that 65.5% of women were obese compared to 51.5% of men. Earlier studies have shown similar trends, for example El-Hazmi and Warsy (1997) researched obesity in 14,660 adult Saudis in 35 different regions of Saudi, and found 13.05 % of males were obese as opposed to 20.26% of females. These findings are consistent with other statistics indicating that women have a higher obesity rate than men in Saudi Arabia (Al-Nozha et al., 2005). This global health issue is therefore now seen to be affecting women at a vulnerable stage of their life; pregnancy. For example, 18.5% to 38.3% of expecting women in the USA are reported as obese, making it one of the main recurrent high-risk obstetric situations (Amir & Donath, 2007; Galtier-Dereure, Boegner, & Bringer, 2000).

As stated earlier, research by Al-Nozha et al. (2005) as well as Khashoggi, Madani, Ghaznawy, and Ali (1993) found that women of Saudi Arabia are the group that are most at risk of obesity, and are therefore likely to experience associated complications throughout the processes of fertility and motherhood. For example, in the study by Al-Nozha et al. (2005) practitioners from different universities and departments of medicine prepared a research paper as part of a major national project regarding the obesity situation in the Kingdom of Saudi Arabia. Among the findings of the study, it was discovered that females were significantly more obese with a prevalence of 44% than males, 26.4%. One study conducted from 1990 to 1993 with 10,651 participants (aged > 20 years) reported female obesity prevalence of 26.6% compared to the obesity prevalence in males of 17.8% (Al-Nuaim, 1997). A clinic based study also observed an overall overweight and obesity rate as high as 65.4% ( $BMI \geq 25 \text{ kg/m}^2$ ) among women aged 18 to 17 years (Rasheed, Abou-Hozaifa & Khan, 1994).

## **2.6 Rationale: Gender and Physiological Basis of Obesity Risks**

In addition to cultural and socio-economic factors, biological factors may also explain the differences in obesity between males and females. While biological disposition accounts for females being the gender with the greatest obesity potential, the Worldwide Obesity Epidemic study cites lifestyle factors as being a reason for this difference. Biologically, women have more fat tissue than men. Women are more prone to obesity than men and this discrepancy has been explained as a biological disposition due to the fact that men have a greater ability to deposit more lean than fat tissue when imbalance occurs. In males, the lean tissue remains metabolically active which causes an increase in the basal metabolic rate. This process effectively enables men to balance the difference between intake and energy output through activity. Women have more fat tissue than men which means they would need to gain significantly more weight in order to generate additional lean tissue required to reach a level of adaptive gain in basal metabolism in order to balance any excessive intake (James et al., 2001).

In addition, women are twice as likely as men to experience a major weight gain (an increase in  $BMI \geq 5 \text{ kg/m}^2$ ) over a 10-year period (Williamson et al., 1990). Women aged 25 to 34 have the greatest risk of major weight gain compared with men of all ages and compared with older women (Williamson et al., 1990).

## 2.7 Age Factors

The prevalence of obesity with regards to age demographics in Gulf countries specially in the Kingdom of Saudi Arabia has been well documented in the Obesity in Saudi Arabian Study (Al-Nozha et al., 2005). The research found a correlation between females and males and age brackets; participants who belong to the 40-49 year age bracket had the highest prevalence of obesity, followed by those in the 50-59 year age bracket, then those in the 30-39 year age bracket and the lowest prevalence presented among participants in the 60-70 bracket. Obesity rates in Saudi adults increase with age until they reach the 60-70 age group when prevalence drops to a rate below that which is exhibited in the youngest age group. There were also differences between men and women; for men, the prevalence rates of obesity are 25.2% in the 30-39 group, 30.3% in the 40-49 group, 27.8% in the 50-59 group and lowering to 25.2% in the eldest group. For women, the prevalence rates of obesity are higher than men across these age groups, with 40.2% in the 30-39 group, 50.2% in the 40-49 group, 45.9% in the 50-59 group and lowering to 39.0% in the eldest group (Al-Nozha et al., 2005). This is demonstrated simply in Figure 1 below.





Figure 1: Prevalence of Obesity by gender and age groups. (Al-Nozha et al., 2005).

## 2.8 Values, Attitudes, Behaviors, and Lifestyle Issues

The presence of housemaids in Gulf countries households mothers seems to be related to obesity. The presence of a housemaid was reported by Rasheed (1998) to be 58.8%, 33.3% and 28.5% of severely obese, mild-moderately and non- obese women respectively. Other individual perceptions informed by cultural norms factors included self image, where by a sizable group of mild-moderately obese (36.8%) and severely obese (23.5%) females had a favorable self body-image and considered themselves of normal weight. A preference for being overweight was also reflected in the response of 19.4% of normal weight women desirous to increase their weight and, 15.8% mild-moderately obese females to either remain the same size or increase their weight. A significant association was observed between literacy level and preference for the ideal body size. The 'little overweight' female figure was considered an ideal body size by a significantly larger group of women without formal education and who were illiterate (27.3%) and those with primary/intermediate education level women (39.5%) compared to those who had undergone high school or college education (Slochower & Kaplan, 1980). Although Rasheed (1998) shows that common risk factors for female obesity in Gulf countries are due to several reasons such as consumption of calorie rich diets, the traditional system of food hospitality, lack of physical activity together with a lack of awareness regarding obesity status, it is the specific attitudes and behaviors related to eating and exercise by individuals within the local population that determine their weight status.

For women in Gulf countries, exercise as a routine activity in life is not common. Moreover, opportunities to attend child and adult health clubs for this purpose are also limited. The local girls' schools do not include exercise routines in the schedule for their school programs (Rasheed, 1998). A large number of individuals in Saudi society perceive being overweight or obese as being healthy, in contrast to the western world. James et al. (2001) along with Galtier-Dereure, Boegner, and Bringer (2000) and Madani (2000) concur that lifestyle trends dictate that the increased consumption of low quality foods occurs simultaneously with reduced physical activity due to the adoption of increasingly sedentary lifestyles.

Physical activity is not part of the daily routine of pregnant women in Gulf countries. There is a clear lack of health promotion activities that encourage healthy lifestyle and healthy eating behavior. Despite this issue, it has been argued that pregnant women in the Gulf state do not have sufficient knowledge and education available around the necessity of living a healthy lifestyle in order to maintain wellbeing (Khashoggi et al., 1993).

There are no sufficient support networks in place to enable women of this group to take proactive and preventative approaches to weight loss and the minimization of obesity related complications. For example, Khwaja and Al-Sebai (1987) conducted a study on 467 married non-pregnant Saudi female patients. The cut-off point of  $>30$  for the BMI was used as an indicator of obesity. The study found that within the group obesity was as high as 27% and linked the cause to grand multiparity, the births of five or more viable infants, which is common in Saudi families. In other cases, it has been seen that the duration between pregnancies is short and does not enable mothers to lose pregnancy related weight gain (Madani, 2000). The inability to lose weight between pregnancies is just one of many adverse health and lifestyle problems this group faces, resulting in a vicious cycle of ill-health and the increasing difficulty to even begin obesity prevention.

The level of education plays a role in the prevention of obesity globally with statistics showing a correlation between obesity and groups with low levels of education. In regard to Gulf countries, the above is true. A further distinction can be made between rural and urban areas within the Kingdom. This distinction is not necessarily due to a lack of information, rather due to people of each area having different attitudes towards health information. This results in varied adherence to advice from health professionals (Khashoggi et al., 1993). Coupled with these issues there is also the lack of dieticians in Saudi Arabia (Almajwal et al., 2009).

The World Health Organization (2003) highlighted that obesity in the Arabian Gulf countries is considered an urgent public health problem. This urgency led to the commissioning of a study called 'Obesity in Saudi Arabia' to form part of a large scale national project 'Coronary Artery Disease in Saudis Study' in 2005. The study showed clear evidence of a high prevalence of adult obesity throughout the Kingdom. The findings included the startling fact that 83% of Saudi adults are obese (Madani, 2000). The impact of obesity throughout the Kingdom of Saudi Arabia is consistent with obesity related health risks not only globally but with that of the nearby Gulf States. Furthermore, major economical development in the Gulf States over the last 30 years has resulted in a significant change in lifestyle with respect to nutritional habits and exercise. This, coupled with social and cultural beliefs, has worsened the issue (Al-Nuaim, 1997).

In addition to biological factors, lifestyle differences are also thought to exacerbate the differences between men and women (James et al., 2001). The study points out that women are more likely to be in a domestic environment and therefore have a constant access to food, resulting in snacking between meals.

This study aims to review the literature by examining the role of pregnancy in the development of weight increase, and to conduct a modified qualitative systematic review on the prevalence of obesity among pregnant women living in Gulf countries, with the goal of developing evidence based guidelines for intervention. Moreover, the dissertation will identify the evidence available about the role of social and lifestyle factors contributing to the prevalence of obesity among pregnant women in Arabian Gulf countries.

## **Chapter Three: Methodology**

This chapter discusses two methods firstly the modified systematic review process, to answer the first and second research questions. Secondly, a general literature review is conducted to provide explanation for the complication and the intervention sections.

### **3.1 Method One: A Modified Qualitative Systematic Review**

The methodology used in this research is a modified systematic review. To understand what a modified systematic review is, it is important to define a traditional systematic review. According to Kitchenham (2004) a systematic literature review is a process that involves identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest. Other authors emphasize the characteristics of rigor and transparency of procedures in systematic reviews such as an explicit study protocol, addressing a pre-specified, highly focused question(s); explicit methods for searching for studies; appraisal of studies to determine their scientific quality; and explicit methods, including descriptive summary or meta-analysis (where appropriate), to combine the findings across a range of studies (Egger, Smith, & O'Rourke, 1995).

According to Dixon-Woods, Fitzpatrick, and Robert (2000) a modified systematic review is usually conducted in an area where only few studies have been conducted, whereas a full systematic review is possible to conduct where a large number of quantitative studies are available for analysis. However, some of the processes involved in the systematic review which include pre-planned search strategies and methods of appraising literature will be borrowed and modified to suit research in an area with few studies that have been published. The other feature of this modified systematic review is that while traditional systematic reviews focus on quantitative randomized controlled trials, this study will mainly include qualitative original studies.

This modified systematic review follows a process where studies that address different aspects of the topic are investigated and conclusions as to relevance to the specific research question will be drawn. The study will therefore be done in two phases. The first being a scoping phase to see what has been written about the topic and the second will be a focused search on the specific aspect of the research question in terms of geographical area. The

systematic review in this dissertation is conducted in two stages. Stage one refers to answering research question one and two, while stage two of the review is conducted to answer research question three and four. Figure 2 below demonstrates the modified systematic review process.

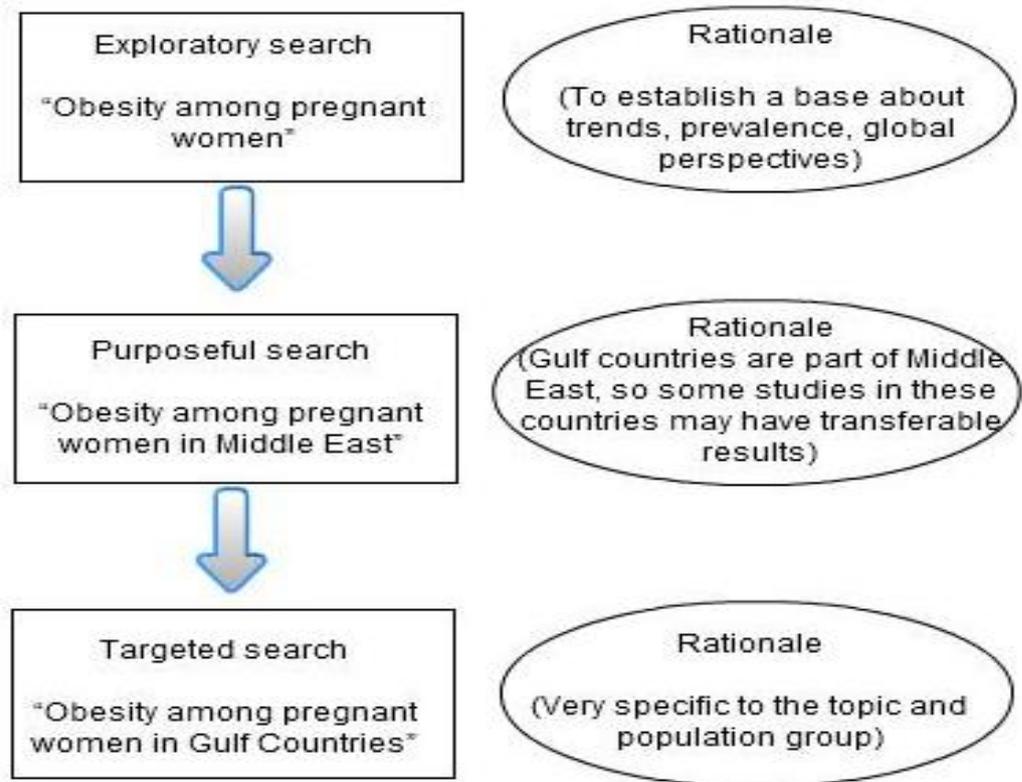


Figure 2: The modified systematic review process.

### 3.1.1 The Searching Process

Searches were made in the following databases: MEDLINE via PubMed, Proquest Central, Scopus, Google Scholar, and academic Premier via EBSCO. The first phase, aiming to find studies in general about obesity during pregnancy was generic in nature and studies were not confined to a specific geographical area in the world, while the second phase was specifically focusing on Middle East were aiming to find studies in these countries tend to cultural similarities. Social and cultural factors are important in this dissertation as they relate to the aims of this study seeking to find social and lifestyle factors cogent in the prevalence of obesity in Gulf States. A mechanism was also developed for regular update of the literature. Searches in databases were supplemented with hand searches as a way of extending on the strength of electronic searches. The hand searching process involved investigating the bibliographies of published papers as well as searching indexes of journals that were thought

to potentially have publications that relate to this dissertation. These journals included the health journals in the Gulf countries. A mechanism was also developed to identify grey literature, such as unpublished studies or those listed on the worldwide web. An attempt was also made to identify ongoing trials. For example; information produced and distributed on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing i.e. where publishing is not the primary activity of the producing body. The reason for using grey literature is due to limited published articles in Gulf countries with relation to my research and moreover, it is a reliable literature.

### **3.1.2 Expanded Searches for Social Issues**

As this dissertation is also interested in understanding social issues around obesity among pregnant women, some of the multi-disciplinary databases such as the Academic Search Premier and the Proquest Central were also searched with the same key words. Specific Sociology databases such as Sociological Abstracts and Sociology were also searched for social issues. The search began with generic, scoping, exploratory phase by general key word of “obesity among pregnant women” and the search generated 60,600 hits in Google Scholar. After that, the search was narrowed down by reading the relevant title to specific key words which were firstly; obesity and women in Gulf countries, secondly; obesity and pregnant women in Gulf countries, thirdly; obesity and lifestyle in Gulf countries, then, finally; obesity and lifestyle/culture/values in Gulf countries, finally, obesity and complications and pregnant women in Gulf countries. See follower details in table 3.

### 3.1.3 Inclusion and Exclusion Criteria

An inclusion and exclusion criteria was determined as shown below in Table 3.

Phase One	Phase Two
<p style="text-align: center;"><b>Inclusion</b></p> <ol style="list-style-type: none"> <li>1. Is the study targeting the issue of obesity among women?</li> <li>2. Is the study published in a professional or peer reviewed journal?</li> </ol>	<p style="text-align: center;"><b>Inclusion</b></p> <ol style="list-style-type: none"> <li>1. Is the study addressing social, cultural and behavioral variables of the topic?</li> <li>2. Is the study targeting the issue of obesity among women/pregnant women in Gulf countries?</li> <li>3. Is the study addressing pregnancy complication associated with obesity e.g. pre-eclampsia, pregnancy induced hypertension etc.?</li> <li>4. Is the study addressing social and lifestyle factors related to the prevalence of obesity among women/pregnant women in Gulf countries?</li> <li>5. Is the study published in a professional or peer reviewed journal?</li> </ol>
<p style="text-align: center;"><b>Exclusion</b></p> <p>Articles published in popular magazines. Studies addressing issues related to obesity without making reference to pregnant women</p>	<p style="text-align: center;"><b>Exclusion</b></p> <p>Articles published in magazines. Studies addressing issues related to obesity without making reference to pregnant women</p>

Table (3): An inclusion and exclusion criteria

#### 3.1.4.1 Results of the databases search

In stage one the dissertation conducted a systematic review of studies done on the evidence of pregnancy complications among women in the Arabian Gulf. There are 20 Arabian Gulf studies which related to obesity among pregnant women. Sixteen relate to the first two questions and the other four relate to the third question that on obesity complication during pregnancy. In addition, only one study is found on Qatar as studies about obesity in Qatar is very limited (Musaiger et al., 2000).

Figure 4 below outlines the results of systematic review in pregnant women on Gulf countries.

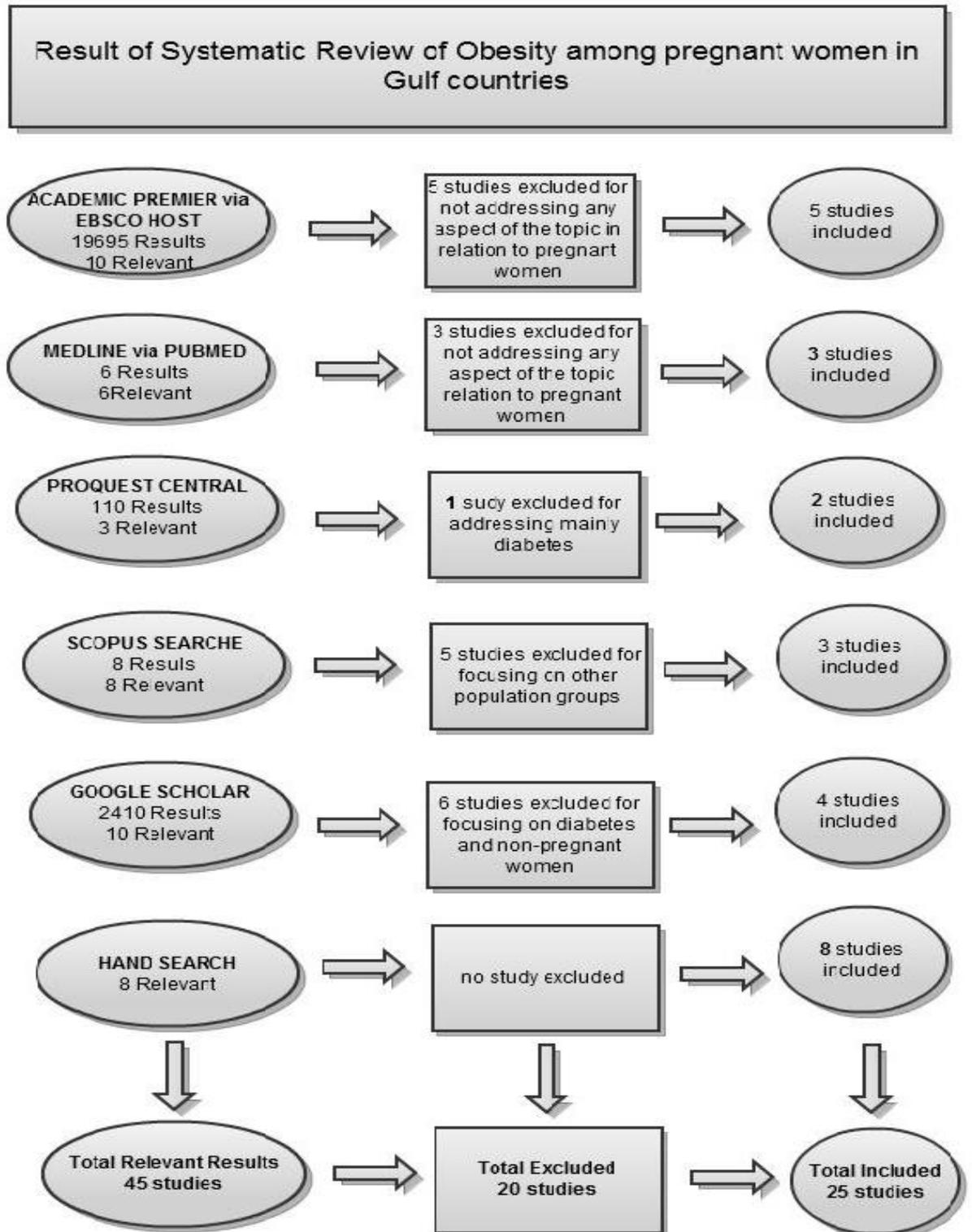


Figure 4: The results of systematic review of pregnant women in Gulf Countries.

### **3.1.4 Assessment of Study Quality**

Due to the modification of the systematic review standard, tools for evaluating literature were adapted and adopted for the study. A criterion was devised from adapting three studies suggested by Schmitt, Nicholson, and Schmitt (2007) which include study types, likelihood of bias in measurement adopted, self-report or actual measurement.

The systematic search was augmented by a manual search from the references in the original papers. After conducting an inclusion and exclusion process to select items for a critical appraisal, the final step was to study articles to conduct an analysis. In order for me to ensure the level of quality with a certain level of objectivity, a colleague (PhD student who has background and works in systematic review) was consulted to moderate the selection process.

A large bulk of the articles that were yielded by the search strategy were review articles. Review articles tend not to focus on original research but rather present a narrative of many different articles on a particular topic and field of research. They also summarize the progress in some particular area or topic in a particular period of time. Some articles were summarizing the current state of knowledge of the topic of obesity among women. This aided an understanding of the topic as most of these also synthesized the results from several primary papers on the topic.

## **3.2 Method Two: General literature Review**

The general literature review in this dissertation is to answer the third and fourth research questions, which aims to identify evidence available about the efficacy of documented interventions in Gulf countries and to clarify current level of knowledge and to direct future research in the area of complications of obesity among pregnant women living in Arabian Gulf countries.

In this method the search begin with grey literature search including websites and bibliographic search, specific geographical journal search. The main database that was used to search was Google Scholar using general key words such as “pregnancy complication” to select some diseases related to obesity during pregnancy. After that, the search was using specific key words as obesity interventions for women, obesity and prenatal care.

More specific key words related to Gulf countries such as obesity interventions of Gulf countries, obesity interventions for pregnant women in Gulf countries, and obesity and prenatal care Gulf countries were also added and the result found only four studies.

In order to answer the third research question (What evidence is available about the pregnancy complications related to obesity among pregnant women?), and fourth research questions (What are the ways in which the identified issues could be addressed to reduce obesity and its complications for Arabian Gulf women?) the general literature review included 99 relevant studies on complication and intervention of obesity during pregnancy. Only four studies were done in Gulf countries and the other 95 were from other westerns countries. Overall, there were 91 studies relevant to the complication of obesity during pregnancy, and only 8 studies to address the fourth research question.

To sum up, this chapter explains that the dissertation was conducted in two stages the first stage was a modified systematic review to answer research questions number one and two, and the second stage was a general literature review to address research questions number three and four.

## **Chapter Four: Results**

This chapter discusses the studies found and their relevance to answering the research question. The chapter also includes tables showing some samples of selected studies and discusses how selected studies were arrived at and the processes followed.

As has been shown in the figure four, of Chapter three (page 28), a total of 45 studies were considered on obesity and pregnancy. In another stage, 25 studies for data abstraction met the inclusion criteria, and the other 20 were eliminated for the reasons pertaining to emphasis on nutrition and breastfeeding, rather than breastfeeding as an obesity and pregnancy outcome.

As has already been discussed in the methodology section, these studies are either primary or secondary studies and they comprised community surveys, case control studies, randomized controlled trials, retrospective cohort studies and prospective studies. These were analyzed and tabulated as can be seen in the figures below. These studies together comprised 4,500 pregnant women excluding control groups. As for experimental studies, all the studies comprised healthy patients. It can therefore be seen that most of the experimental studies detailed below were from the European developed countries.

Due to the limited scope of information, and for consistency and simplicity in comparison where studies from Arabian Gulf countries were not available, studies from European countries were selected. The selected European studies provided information the other studies did not address.

### **4.1 Data Synthesis and Analysis by Classification into Key Topic Areas**

The retrieved articles were classified into key topic areas. Each study was scanned for relevant material in answering the research questions. Studies with similar qualitative studies were pooled together. Before classifying topics into groups, it is necessary to recapture the purpose of this systematic review.

The literature review aimed to identify evidence as follows:

- a) To conduct a modified qualitative systematic review on the prevalence of obesity among pregnant women living in Arabian Gulf States.
- b) To identify evidence available about the role of social and lifestyle factors in contributing to the prevalence of obesity among pregnant women in Arabian Gulf countries.

- c) To clarify current level of knowledge and to direct future research in the area of complications of obesity among pregnant women in Gulf countries.
- d) To identify evidence available about the efficacy of documented interventions in Arabian Gulf countries with the goal of developing evidence based guidelines for intervention.

The following sections will answer the research questions using the selected studies as mentioned in chapter three.

## **4.2 Findings One: Modified Systematic Review**

### **4.2.1 Prevalence of obesity among pregnant women in Gulf Countries**

This section answers the first research question. Before mentioning the biological, lifestyle and socio-cultural factors it is important to establish the prevalence of obesity among pregnant women in Gulf countries. In this section, a set of nine articles were pooled together, that had the aim of investigating the prevalence of overweight individuals in a particular population group. For the purposes of rigor in verification of the suitability of the articles, a check of study aims, topic and conclusion was completed to ensure the thread joining the articles was consistently apparent.

The results have reported figures from the Gulf countries showing the prevalence of obesity and that includes pregnant and non-pregnant women, is 35% as noted by Carter et al. (2004) then the percentage is decreased to 24% in study was done by Sheikh-Ismail, et al. (2009) of the population in the United Arab Emirates, 46% in Kuwait, and 34.9% in Bahrain. Aside from Kuwait, Saudi Arabia's prevalence of obesity is one of the highest in the Middle Eastern region, at 35.6% (Carter et al., 2004; Musaiger & Al-Mannai, 2001; Sorkhou et al., 2004).

It has been argued that in developing countries, especially Muslim countries, population-prevalence studies are difficult, particularly for women, because of lack of access to a representative sample of community-dwelling people and reticence on the part of subjects to participate (Bolle, 2006). It is therefore important to pursue the issue of prevalence in this study which is based on a setting where there has been very little done on the subject.

The particularly relevant prevalence study by Carter et al. (2004) is the most important finding of this study. The study revealed the high prevalence of 35% of obesity, among the targeted female population of the United Arab Emirates. Since the study population was a random sample of female United Arab Emirates citizens residing in Al Ain city, this

prevalence can be extrapolated at least to the female population of this city and possibly to the urban female population of the United Arab Emirates. With reference to pregnant women, studies predicting such a high prevalence are important for planning obstetric care of pregnant women. Another study of the United Arab Emirates reported that nearly 40% of married women are obese (Kumari, 2001).

Another important prevalence study is the one by Musaiger (2004) which was carried out in Bahrain. This study, which considered overweight and obesity as anyone within a BMI above 25, showed obesity was more prevalent among women than men. This study was conducted in the year 2000 and reported that the prevalence of obesity among women was as high as nearly 80% in 1995 making Bahrain one of the highest affected countries in the Gulf in terms of obesity. Another issue of interest is that such high prevalence rates seemed to have doubled from 39% in 1980 to nearly 80% in 1995. It must also be noted that the prevalence of diabetes, which is usually associated with obesity, was documented to be one of the highest in the world (Al-Mahroos & McKeigue, 1998).

As a way of concluding prevalence, one can surmise that the issue of obesity among pregnant women in Saudi Arabia and other Gulf countries is still increasing alongside the trends of modernization in these countries. Another issue to be deduced is that the prevalence trends seem to be consistent in Gulf countries.

Table (4) selected studies of prevalence of obesity among pregnant women in Gulf countries

Study	Population	Study findings
Carter et al. (2004)	A cross-sectional survey was to determine the reproductive and lifestyle characteristics in a representative sample (n=535) of women in Al Ain, United Arab Emirates	A transferable knowledge study that emphasized both treatment and prevention
Musaiger, and Al-Mannai (2001)	A cross-sectional survey of 514 Bahraini native adults aged 30-79 years was selected from households using clustering sampling technique.	Findings indicate that Bahraini adults were shorter but heavier, and have higher mean BMI than their Western counterparts, suggesting a trend to obesity. The overall prevalence of overweight and obesity was 35.2% and 21.2% for men, while that for women was 31% and 48.7%, respectively.
Sorkhou, Al-Qallaf, Al-Namash, Ben-Nakhi, Al-Batish, and Habiba (2004)	A population of 250 Kuwaiti hypertensive patients (129 males and 121 females) over the age of 40 were screened for metabolic syndrome by determining body mass index (BMI), waist circumference, levels of fasting plasma glucose and fasting plasma lipids.	The total number of patients who met the criteria for metabolic syndrome was 85 (34%), 55% of them were males and 45% females. Prevalence of the syndrome was 28.2% among 40- to 55-year-olds and 41.9% in those above the age of 55 years. 52.8% (54% males and 46% females) Obesity measured as BMI = 30 kg/m <sup>2</sup> was noted in 46% (43% males and 57% females)
Al-Nozha et al. (2003)	Saudi subjects in the age group of 30-70 years of selected households over a 5-year period between 1995 and 2000 in KSA. Data were obtained from body mass index (BMI) and were analyzed to classify individuals with overweight (BMI = 25-29.9 kg/m <sup>2</sup> ), obesity (BMI <sup>3</sup> 30 kg/m <sup>2</sup> ) and severe (Gross, Sokol, & King) obesity (BMI <sup>3</sup> 40 kg/m <sup>2</sup> ) to provide the prevalence of overweight and obesity in KSA.	The prevalence of overweight was 36.9%. Overweight is significantly more prevalent in males (42.4%) compared to 31.8% of females. The age-adjusted prevalence of obesity was 35.5% in KSA with an overall prevalence of 35.6% while severe (Gross et al.) obesity was 3.2%. Females are significantly more obese with a prevalence of 44% than males 26.4%
Kumari (2001)	One hundred and eighty-eight	Morbidly obese women were noted to have

	singleton pregnancies of women with first trimester BMI >40 who delivered in Abu Dhabi. A control group of normal body mass index matched for age and parity were selected and the perinatal variables were compared between groups.	significantly adverse perinatal outcomes including hypertensive disorders of pregnancy (28.8 vs. 2.9%, P<0.0001), gestational diabetes (24.5 vs. 2.2%, P<0.0001), cesarian section (15.2 vs. 9.3%, P<0.05) and macrosomia (32.6 vs. 9.3%, P<0.001) compared to non-obese women.
Bolle (2006)	Report in changes in the Omani socio-economics factors.	Oman is trying to liberalize and diversify its trade regime beyond oil and gas to provide economic opportunities for its fast growing workforce. Supporters of the agreement typically cite political and economic reasons. Opponents typically point to labor and human rights issues
Musaiger (2004)	Invited paper Overweight and obesity in the Eastern Mediterranean Region: can we control it? (literature review)	Increase in obesity generally has been noted among women showed a higher prevalence of obesity (35%–75%) %. Several factors, such as change in dietary habits, socioeconomic factors, inactivity and multiparity determine obesity in this region.
Al-Mahroos and McKeigue (1998)	A cross-sectional study of 2,128 Bahrainis aged 40–69 years.	Although 28% of participants had BMI $\geq 30$ kg / m <sup>2</sup> , only 42% of these obese individuals rated themselves as overweight. In women, obesity was associated with high parity and inversely associated with employment outside the home.
Sheikh-Ismail, et al. (2009)	The purpose of this present study was to investigate the prevalence of overweight and obesity in adult females in the United Arab Emirates. A total number of 724 females, age 20-90 years, were recruited from the seven Emirates. The sample was divided into three age groups, 20 to 30 years, 30 to 60 years. Height, weight and mid-upper-arm circumference were measured in each subject.	Overweight and obesity were defined as a body mass index of 25.0 to 29.9 kg/m <sup>2</sup> and $\geq 30$ kg/m <sup>2</sup> , respectively. The prevalence of overweight and obesity were 27% and 16%, respectively. The age group between 30 and 60 years had the highest prevalence of overweight (33%) and obesity (24%). The findings from our study suggest that a high proportion of adult females in the United Arab Emirates are overweight and obese. The consequences of this are a serious concern for public health and need to be addressed.

## **4.2.2 The role of economic, social, behavioural and lifestyle factors in pregnant women in Gulf Countries**

In public health terms, these factors can be related to biological and social determinants of health. The findings of the results follow.

This section answers the second research question, what are the prevalent economic, social, behavioral, and lifestyle factors associated with obesity among pregnant women in Arabian Gulf countries. Only nine studies from the selected studies provided specific reference to Gulf countries and focused on socio-cultural variables. Only three studies make specific reference to pregnant woman in Gulf countries and it was hard to yield studies that shared socio-cultural determinants with regards to obesity.

While many of the studies tended to generalize on the complications related to pregnancy, one study focused on the aspect of hypertensive disorders among pregnant women (Mahfouz, EI-Saidb, Alakija, & Al-Erian, 1994). The strength of this study was the fact that it looked at a number of social determinants. Indeed, the results of the study were that there are some environmental, biological and lifestyle factors that lead to pregnancy-induced-hypertension. Another significant thing about this study is that it is one of the few studies that recommended specific education of the risk obesity in pregnancy, the importance of physical activity and exercise, and health education programs for pregnant women at primary care level.

Another study that contributed to the above study was done by Carter et al. (2004) which focused on Assessment of Obesity, Lifestyle, and Reproductive Health Needs of Female Citizens of Al Ain, United Arab Emirates. There is a caution about two things in this study. Firstly, this study was not done solely on pregnant women, and secondly this study was not looking at pregnancy related complications but rather at obesity risks. Even though this is the case, this study has knowledge that can be transferable, which means using knowledge that has been researched in one country to explain an issue in a different setting or country. It identified the influences of age and education factors. However, as has been noted earlier, UAE is a country with a fast changing lifestyle which is probably not at the same rate as Saudi Arabia. Another social determinant identified by this study was the one about the role of affluence. However, since this study was done on affluent populations, generalizations should be done to similar affluent populations in Saudi Arabia as it had been noted that affluent populations in Saudi Arabia and in UAE live similar lifestyles (Carter et al., 2004).

A study was done by Musaiger (1990) in Bahrain, which was a cross-sectional survey of natives between the ages 30-70 years also conducted to research in this area. Although the study surveyed both sexes, the important thing was that it is one of the few studies that identified sex, age and social determinants as important in looking at issues around the prevalence of obesity. Perhaps the other important contribution of this study was the fact that it identified such social determinants as marital status, lifestyle, smoking and eating habits as contributing factors to the prevalence of obesity.

Additional to the above studies is the study done by Rasheed (1998) which was a case control study of obese and non-obese and non-pregnant woman in urban Saudi Arabia. An important feature of this study was that it is one of the few studies that reported psychosocial factors and emotional factors as contributors to obesity related behaviors such as snacking and eating unhealthy food as well as not doing physical exercise. This is an important dimension in understanding the social determinants of obesity.

A historical study by Khashoggi et al. (1993) which was conducted in 1989 also contributed to this information. For example it was found that 87% of Saudi women between the ages of 50-70 were obese. This historical study also commented that marital status was correlated with chances of being obese. This study also commented about Westernization in terms of attitudes of young girls, and indicated that young girls are now exposed to Western cultures and eager to adopt slimmer body sizes. If this hypothesis is to be taken to be correct, then more younger girls may be adopting slimmer and slimmer body sizes since this was reported in the 1980s.

The social determinants of obesity among pregnant women in Gulf countries relate to a number of factors including lifestyle, cultural, economic and social factors. For example, in terms of lifestyle a study by Madani (2000) concurs that lifestyle trends dictate that the increased consumption of low quality foods occurs simultaneously with reduced physical activity due to the adoption of increasingly sedentary lifestyles. With recent socio-economic changes, a sedentary life-style of women and culturally mediated factors of the local population have been cited as the pervading influences for the high prevalence of obesity (Al-Riyami & Afifi, 2003; Rasheed, 1998).

Other factors forming this profile are due to variations around socioeconomic factors and gender. Financial constraints of the poor and less educated groups within Saudi Arabia mean they are more likely to engage in inactive pastimes such as watching television or other

technology based activities. Such activities are cheaper, require less initiative and consequently don't necessitate significant energy expenditure or social interaction (Khashoggi et al., 1993).

The socio-economic level women belong to has also been found to be linked to obesity prevalence rates. Madani (2000) concluded that a BMI is generally greater the higher the social level. However, in contrast, women from urban regions with higher-income society experienced a marked reduction in obesity prevalence from 12.8% to 9.2% between the period 1989 to 1997 (Madani, 2000).

The level of education plays a huge role in the prevention of obesity globally with statistics showing a correlation between obesity and groups with low levels of education. Being of a higher social level brings the education and income necessary to expose women to information in order to fully understand obesity related issues. With a greater access to education and the media, women of higher income quartiles in urban environments are more likely to be knowledgeable when it comes to good nutrition habits, the importance of exercise and healthy lifestyles. It is possible for these women to have sufficient income to purchase healthier foods and the time to be able to engage in physical activity. Women of these groups have a greater interest in self-image and are more likely to adopt positive exercise and nutritional programs in order to prevent unnecessary weight gain (Madani, 2000).

In addition to the above stated economic issues, socio-cultural issues have also contributed to the prevalence of obesity. For example, it has been observed that early marriage age may be one of the risk factors affecting the health and nutritional status of mothers and their children, especially in rural areas (Musaiger, 1990). The first pregnancies were quite early, as 56.7% occurred before the age of 16 years. Another old study by Abduljabbar and Wong, (1988) showed a slight increase in the age at marriage among Saudi women, but they still got married when they were below 20 years of age. The average age of marriage was 18.3 years, with 14% of women less than 15 years of age when married.

Knowledge of cultural issues associated with marriage age is important especially considering that most literature on obesity among pregnant mothers is based on observations made in western countries where the marriage age differs significantly (Babay, Addar, Shahid, & Meriki, 2004). Table 5 below listed all selected studies used to answer the second question.

Table (5): Selected Studies on Prevalence, and Social Determinants of Obesity from Gulf Countries.

Study	Population	Study finding
Mahfouz, EI-Saidb, Alakija, and Al-Erian (1994).	A stratified random sample of 3988 pregnant Saudi Arabian women was interviewed for sociobiological conditions and examined for blood pressure, proteinuria and body mass.	One of the few studies that identified a multiplicity of factors such as multiparity, altitude, child spacing as risk factors for hypertensive disorders in pregnant women
Carter et al. (2004)	A cross-sectional survey on reproductive and lifestyle characteristics in a representative sample (n=535) of women in Al Ain, the United Arab Emirates	A transferable knowledge study that emphasized both treatment and prevention
Musaiger (1990)	A cross-sectional survey of 514 Bahrain natives aged 30-70	Caution as both sexes were surveyed
Khashoggi, Madani, Ghaznawy, and Ali (1993).	A case control study focusing on comparison between obese and non-obese Saudi Arabian women in urban areas	A historical study conducted in 1989. The aim of taking historical studies is to establish trends
Rasheed (1998).	A case control study examining the differences in self concept of body image among obese and non-obese women 74 obese and 70 non-obese and non-pregnant women	Association of concept of body image with age. The role of emotional factors such as stress and psychosocial factors like self concept
Al-Riyami, and Afifi (2003).	To determine the prevalence of obesity and central obesity among Omani adults aged >20 years, and to identify the socio-demographic and health variables that correlate to obesity and central obesity in a community based survey (National Health Survey, 2000).	Acknowledged the role of cultural revolution in self concept of body image
Babay, Addar, Shahid, and Meriki (2004)	Age, at menarche, marriage, and age of first pregnancy, number of children, and number of abortions were collected for Saudi women attending King Khalid University Hospital (KKUH) over a 3-month period among 989 Saudi women. The mean age at menarche was 13.05 years.	Increase in the age of marriage, age of first pregnancy, and a decrease in the number of children and abortions. Compared with data from two decades, the age at menarche decreased significantly from 13.22 to 13.05 years

To conclude this section although biological determinants emerged, more studies are still needed to advance arguments around this issue. On the social determinants one may conclude that more and more current research still need to be done around the findings that Arabian girls are now adopting the slim body culture in line with Westernization trends.

### **4.3 Findings Two: general literature review**

The findings from the general literature review are general because it can be transferable knowledge to Arab pregnant mother in Gulf countries. There were 99 studies found which focused on complications and intervention for obesity during pregnancy. To answer the third question there were 91 studies relevant to the complication of obesity during pregnancy four of those 91 were from Gulf countries while only 8 studies address the fourth research question.

#### **4.3.1 Evidence on complications related to Obesity among Pregnant women**

This section is based on general review which is from non-Gulf countries studies. It also answers the third research question, from a review of the selected studies, 'what is the evidence available about the complications related to obesity among pregnant women'. The risks and complications related to obesity among pregnant women in other countries appear transferable knowledge to the "Gulf Countries" context. It is acknowledged that knowledge from other countries should be incorporated into this discussion with caution because these countries have environmental and lifestyle factors that affect the outcome of pregnancy. The most recent and most relevant study is a prospective Saudi Arabian study by El-Gilanya and Hammad (2010) which examined the relationship between BMI and obstetric outcomes. This study included 787 women of which 187 were overweight and 226 were obese. The risks identified in this study included pregnancy-induced hypertension, gestational diabetes, pre-eclamptic toxemia, urinary tract infection, caesarian delivery, macrosomia, low 1 minute Apgar score and admission to neonatal care units.

This dissertation excluded women with pre-pregnancy chronic diseases such as diabetes, hypertension, renal and cardiac diseases.

With regards to pregnant women, both low and high gestational weight-gain are of public health concern. For example, low weight gain has been associated with low birth weight, preterm delivery and infant mortality. High weight gain has been associated with macrosomia (Reddy, Branum, & Klebanoff, 2005). These issues will be discussed in this chapter. Therefore, some international guidelines on weight gain had been sought and the guideline by the Institute of Medicine is one such example (Institute of Medicine of the National Academies, 2009).

#### ***4.3.1.1 Energy Expenditure during Pregnancy***

Energy expenditure is important because the lack of this results in body weight gain. Several factors associated with pregnancy do drive energy intake measurements and some of these include diet-induced thermo genesis, which is the increment in energy expenditure after a meal, and protein synthesis (Yu et al., 2006). Another very important factor is the increased energy need during pregnancy. As has already been discussed in regular pregnancy, the increase in energy ingestion is between 0.3 Mg and 0.5 Mg per day (Yu et al., 2006). Total energy expenditure under normal circumstances is as follows: 75% of total energy expenditure comes from Basal Metabolic Rate (BSR) which indicates inactive energy expenditure; 10–15% may come from physical movement or exercise; and 10–15% from thermogenic activities (Yu et al., 2006).

There is a buildup of energy in the additional weight of the mother and fetus in pregnancy, which symbolizes a grouping of distorted energy ingestion together with a distortion in the components of energy expenditure (Yu et al., 2006). This consists of changes in BSR per unit in lean body mass and postprandial thermo genesis per unit in food eaten. Additionally, the raise in lean body mass with the extra weight of pregnancy leads to the alterations in Resting Energy Expenditure (REE) (Yu et al., 2006). The total additional energy requirement of pregnancy is 360 Mg or almost 1.2 Mg per day. The best approximation of normal overall fat increase throughout pregnancy is 3.0 kg. Table 6 below shows the theoretical energy cost of pregnancy. There are dissimilarities in BSR and variation in pregnancy depending on the energy level as well as the adiposity. A serial study using 24 hours calorimetry confirmed that there are high distinguishing changes in every subject with huge inter subject variations (Linne, 2004). Lean women have a tendency to reduce their BSR early during pregnancy but obese and overweight women demonstrated a higher BSR from the starting of pregnancy. The amount of fat mass of women prior to becoming pregnant and the weight increase during pregnancy was associated with the energy preservation cost of pregnancy (Linne, 2004).

Postprandial thermo genesis has been examined in pregnancy. Two researches imply that there are no alterations to the elevation in energy expenditure after a meal (Spaaij et al., 1994). At the same time another two studies have confirmed a decline in postprandial thermo genesis in pregnancy (Spaaij et al., 1994). The latter studies furthermore demonstrated that the drop in postprandial thermo genesis is connected with the level of insulin resistance throughout normal pregnancy (Robinson et al., 1993). This is in concurrence with a study indicating postprandial thermo genesis to be linked with insulin resistance outside pregnancy

(Camastra et al., 1999). Although obese women are more insulin resistant, there have been no specific studies of obesity and postprandial thermo genesis in pregnancy.

Table (6): Theoretical energy cost of pregnancy

	<b>0–10 weeks</b>	<b>10–20 weeks</b>	<b>20–30 weeks</b>	<b>30–40 weeks</b>	<b>Cumulative total</b>
	KJ/day (g/day)	KJ/day (g/day)	KJ/day (g/day)	KJ/day (g/day)	KJ/pregnancy (Kg/pregnancy)
<b>Protein</b>	15 (0.64)	43 (1.8)	112 (4.8)	144 (6.1)	21 800 (0.93)
<b>Fat</b>	234 (5.9)	1065 (26.8)	872 (22.0)	132 (3.3)	157 900 (3.96)
<b>BSR</b>	188	416	622	954	150 000
<b>Total net additional energy</b>	437	1522	1606	1229	329 500
<b>Total net energy + 10%</b>	481	1677	1767	1352	362 400

\*adapted from (Yu, Teoh, & Robinson, 2006).

Through normal pregnancy, maternal insulin resistance is central to alterations in intermediary metabolism. This insulin resistance might be responsible in liberating metabolites for fetal development. Fasting blood glucose levels decline during normal pregnancy. Excursion of glucose on top of fasting particularly after a glucose load seems increased in normal pregnancy (Yu et al., 2006).

Fasting plasma insulin levels elevate through pregnancy, yet these changes do not take place at the same phase as the reduction in glucose concentrations. This would indicate that the insulin and glucose concentrations are not directly associated unless insulin sensitivity is changed or the pancreatic  $\beta$  cell glucostat is put at an altered point (Kuhl & Holst, 1976). Insulin reaction to a glucose or meal challenge increases in normal pregnancy (Freinkel, 1980). Insulin sensitivity is reduced and insulin concentrations are increased in obese compared with non-obese pregnant women, even though these changes are not statistically significant (Jolly et al., 2003). Non-obese women are insulin accepting compared with obese

women (Ludvik, Nolan, Baloga, Sacks, & Olefsky, 1995). Insulin resistance is used to characterize non-complicated pregnancy when investigated with a euglycaemic clamp, an intravenous glucose acceptance test with least modeling of insulin sensitivity or the short insulin tolerance test (Robinson et al., 1993). Hepatic glucose making, when evaluated with stable isotope techniques, is not changed in pregnancy. Obesity outside pregnancy, is not related with a change in hepatic glucose output unless fasting glucose is high such as in diabetes (DeFronzo, 1988). Non-esterified fatty acid (NEFA) concentration is highly effected by the length of fast. Although the NEFA concentrations do rise more quickly with length of fast increasing from 12–18 hours compared with those in non-pregnant women, the fasting NEFA concentrations are perhaps not distorted in pregnancy (Yu et al., 2006).

#### ***4.3.1.2 Pregnancy Induced Weight Gain***

Pregnancy has frequently been cited as a contributor to weight increase in women (Amir & Donath, 2007). Some guidelines (Amir & Donath, 2007) have been made about the average weight gain. For example, the guidelines specify weight gain in each trimester such as stating that in the first trimester, one does not need to gain much weight, with the guideline being only about 0-2 kg. In the second and third trimester, it has been stipulated that steady weight gain is important for baby's growth and development, which can be about 1–2 kg/month. Ohlin & Rossner (1990) found that all women who retained  $\geq 16$  kg or more at 1 year had a pregnancy BMI of  $\geq 26$  or more.

Another point to note is that pregnant women should not forget that when they gain excess weight, they will find it difficult to get back to their pre-pregnancy weight. On this note, although obstetric literature and other scientific guidelines indicate that standard average weight retention ranges from 0.5 to 3 kg; weight retention appears to be highly variable among women, with some women retaining as much as 17.7 kg. Such variations have also been seen in some studies conducted in Western European countries that have shown that excessive weight retention seems to be especially prevalent among minority women (Amir & Donath, 2007).

#### ***4.3.1.3 The General Nutritional Status of Pregnant Mothers in Gulf Countries***

In discussing the issue of obesity it is important that the general nutrition status of mothers during pregnancy is highlighted because discussion of weight gain issues should not be limited to high energy food only but should happen in the broader context of a balanced diet.

Hence, the general nutrition status of Arab Gulf countries will be discussed below. Maternal nutrition has long been observed to be an issue in Arab Gulf countries. For instance, in Oman some cultural attitudes have been observed to have a bearing on weight gain during pregnancy. An example of this would be the tendency of Omani mothers to decrease their food intake during pregnancy, believing that eating extra food will cause an overlarge baby and hence a difficult delivery (Musaiger, 1989).

In Bahrain, it was reported that only 31% of mothers consumed more fresh fruit during pregnancy at the expense of other unhealthy nutrients (Musaiger, 1982). In Kuwait, (Prakash, Shubber, & Abdul-Ghani, 1984) found that the intake of calcium, iron and vitamin C by pregnant mothers was below 75% of US recommended daily allowances (RDA), while among lactating mothers, all nutrients (except protein) were below the RDA.

#### ***4.3.1.4 Pregnancy Weight Gain: The Institute Of Medicine (IOM) Guidelines***

##### ***4.3.1.4.1 The Evolution of the (IOM) Guidelines***

According to Linne (2004) pregnancy weight gain recommendations have a long history characterized by changes in focus over time. An example given is the fact that in the 1950's the recommendations were mainly focused on total weight gain during pregnancy and the stipulated figure was 7–8 kg. The key issue being addressed was the prevention of macrosomia and delivery complications (Dieckman, 1952). However, due to improvements in delivery surgery the recommendations became more liberal. Due to the worldwide recognized changes in body weight among all populations which did not soar women, in the beginning of the 1990s the Institute of Medicine (IOM) responded with recommendations (Linné, 2004). The key difference with previous recommendations was the focus on fetal outcomes rather than maternal outcomes (Linné, 2004).

The new IOM weight gain guidelines for women were classed into pre-pregnancy BMI in the categories of low, normal, average, and high; the low category being  $<19.8$  kg/m<sup>2</sup>, the normal being 19.8–26.0kg/m<sup>2</sup>, and the high being 26.1-29.0 kg/m<sup>2</sup> (Theron & Thompson, 1993). The corresponding weight gains were stipulated as 12.5–18kg, 11.5–16 kg, 7–11.5 kg, and at least 6.0 kg (Oken, Taveras, Kleinman, Rich-Edwards, & Gillman, 2007). A minimum gain of 7 kg, was recommended for obese women (BMI  $>29$  kg/m<sup>2</sup>) while an upper limit of 11.5 kg for the heaviest women was set. One of the goals of these recommendations in

prenatal care was to achieve a full-term delivery of a live infant with the targeted presumably healthy birth weights of between 3000g and 4000g (Arendas, Qiu, & Gruslin, 2008).

Table (7): The new IOM weight gain guidelines

<b>Pre-pregnancy BMI</b>	<b>Total Weight Gain</b>		<b>Rates of Weight Gain* 2nd and 3rd Trimester</b>	
	Range in (kg/m <sup>2</sup> )	Range in lbs	Mean (range) in kg/week	Mean (range) in lbs/week
<b>Underweight (&gt;18.5kg/m<sup>2</sup>)</b>	12.5-18	28-40	0.51 (0.44-0.58)	1 (1-1.3)
<b>Normal weight(18.5-24.9 kg/m<sup>2</sup>)</b>	11.5-16	25-35	0.42 (0.35-0.50)	1 (0.8-1)
<b>Overweight (25.0-29.9 kg/m<sup>2</sup>)</b>	7-11.5	15-25	0.28 (0.23-0.33)	0.6 (0.5-0.7)
<b>Obese (≥30.0 kg/m<sup>2</sup>)</b>	5-9	11-20	0.22 (0.17-0.27)	0.5 (0.4-0.6)

#### 4.3.1.4.2 Validation of the (IOM) Guideline

These guidelines have been critiqued and either endorsed or validated by various organizations. For example one such study, by Parker and Abrams (1993) aimed to compare the national guidelines of the IOM with hospital standards and found that the recommendations of the IOM and the hospital ranges were associated with fewer small for gestational age infants, large for gestational age infants, and cesarean deliveries; hence these results validated the IOM recommendations. In this study it was found that maternal weight gain within the IOM recommendations reduced the risk of the outcomes studied. This study which utilized data collected at Moffitt Hospital, University of California at San Francisco, examined the associations between maternal weight gain outside the recommendations of the IOM and three pregnancy outcomes small for gestational age infants, large for gestational age infants, and cesarean delivery. These analyses were repeated using population-specific weight

gain ranges derived from a subgroup of women in this cohort with healthy pregnancy outcomes.

Some limitations were also observed about these guidelines such as the observation that there was insufficient information available with which to develop even a provisional guideline for underweight women with multiple fetuses. Furthermore, according to the Institute of Medicine it must be noted that these provisional guidelines reflect the interquartile (25<sup>th</sup> to 75<sup>th</sup> percentiles) range of cumulative weight gain among women who delivered their twins, who weighed  $\geq 2,500$  g on average, at 37-42 weeks of gestation. Another observation is that the above calculations assume a 0.5-2 kg weight gain in the first trimester based on Yu et al. (2006).

Other issues about this are allowance for twins, and short women and for racial/ethnic groups are the same as those for the whole population. In addition, teenagers who are pregnant should use the adult BMI categories to determine their weight gain range (Institute of Medicine of the National Academies, 2009). In addition, a study by Schieve (1998) examined the associations between pregnancy weight gain outside and within ranges recommended by the Institute of Medicine; and birth weight by both pre-pregnant body mass index (BMI) and race-ethnicity, concluded that the pregnancy weight gain ranges recommended for low and average BMI women appear reasonable, but recommendations for high and obese BMI women require further evaluation.

However, despite the above limitations these guidelines have been endorsed by reputable medical colleges such as The American College of Obstetricians and Gynecologists (ACOG) (American College of Obstetricians and Gynecologists, 2003).

#### ***4.3.1.4.3 The Importance of Pre-pregnancy Weight Gain According to the (IOM)***

Prior to making recommendations, the Institute of Medicine (2009) reviewed studies that cited reduced perinatal mortality as a benefit of increased pregnancy weight gain. Such evidence indicates that reduced gestational weight gain might cause such issues as preterm delivery. On the other hand, such evidence indicated that reduced maternal weight gain increases the risks of low birth weight (LBW) and fetal growth restriction (Institute of Medicine, 2009).

Apart from perinatal complications, women who have higher pre-pregnancy weights may be at risk for substantial weight retention during and after pregnancy. A study completed in

Sweden associated higher maternal pre-pregnancy BMI with a greater potential to cause adverse consequences related to the pregnancy (Cnattingius, Bergström, Lipworth, & Kramer, 1998). The findings of the study varied with parity status, showing increased problems such as late foetal death and delivery at or before 32 weeks gestation in first time pregnancies. An increase in late foetal death increased in both overweight and obese women compared to women classified as lean, suggesting that there is risk associated with pre-pregnancy overweight as well as pre-pregnancy obesity. Another study by Baeten, Bukusi, & Lambe (2001) focused upon women in their first pregnancies, recorded in Washington State between 1992 and 1996, and classified pre-pregnancy women into lean, normal, overweight and obese groupings. In this study they found that 19.6% were considered lean, 52.1% normal with 18.2% overweight and 10.1% obese, making 28.3% women at risk of additional health complications during pregnancy.

Having given an overview of the Institute of Medicine Guidelines (2009), it is important to have a look at pathophysiological issues related to pre-pregnancy weight gain and obesity.

Women today are particularly at risk of being overweight or obese during pregnancy. They are at risk of generating increased negative health effects throughout the processes around fertility, pregnancy and ovulation if obese. A recent Australian study reported that 34% of pregnant women were overweight or obese; and that overweight/obese women had increased adverse maternal and neonatal outcomes, resulting in increased costs of obstetric care (Callaway, Prins, Chang, & McIntyre, 2006). Baeten, et al. (2001) linked obesity during pregnancy with an increased risk of adverse conditions in both the mother and the baby such as fetal macrosomia, hypertension due to pregnancy, gestational diabetes and the necessity of caesarean delivery (Edwards, Hellerstedt, Alton, Story, & Himes, 1996; Gross, Sokol, & King, 1980). The fact that even with other population groups, obesity is a contributing factor to morbidity and mortality related to heart disease, diabetes and cancer, it should be factored in considering risk factors in pregnancy and obesity risks (Calle, Thun, Petrelli, Rodriguez, & Heath, 1999; Kuczmarski, Carroll, Flegal, & Troiano, 1997). Obesity during these periods may relate to unfavorable complications, including reproductive health problems, such as menstrual irregularity and infertility (Pasquali, Pelusi, Genghini, Cacciari, & Gambineri, 2003). Ante-partum complications include pre-eclampsia, pre-term delivery and multiple births. Intra-partum complications include induction complications, increased need for caesarean sections and potential infection as well as difficulties around anesthesia management. Complications include mortality and increased risks of hemorrhage; breast-feeding complications and the reduction of the duration of breast-feeding. Depression is more

prevalent in obese mothers, the symptoms causing irregular sleep patterns, reduced physical activity and negative dietary habits which all lead to the ongoing cycle of obesity (Pasquali et al., 2003). Maternal obesity is associated with an increased risk of neonates being admitted to a neonatal intensive care unit population based research shows a link between maternal obesity and cardiovascular disease in adult offspring. Also, higher adult rates of type 2 diabetes have been reported in offspring of mothers who were above average weight in pregnancy (Ramsay, Greer, & Sattar, 2006). In addition to these individual complications, the economic cost of managing obese pregnant women has been documented in terms of hospital antenatal care to figures of about five times the care of other women (Ramsay et al., 2006).

#### ***4.3.1.5 Pathophysiological issues associated with obesity during pregnancy***

The path-physiological complications that have been studied include fertility issues, preeclampsia, incidences of induction of labour, operative vaginal delivery, admission to incidences of intensive care units, gestational diabetes and pregnancy induced hypertension. These will be discussed in details below. The first one to be discussed is fertility.

Abrams, Altman, & Pickett (2000) conducted a systematic review of studies that examined fetal and maternal outcomes according to the IOM's weight-gain recommendations in women with a normal pre-pregnancy weight. These studies showed that pregnancy weight gain within the IOM's recommended range is associated with the best outcome for both mothers and infants. However, weight gain in most pregnant women is not within the IOM's ranges (Abrams et al., 2000).

##### ***4.3.1.5.1 Fertility***

In addition to several reproductive disturbances, obesity has been seen to be associated with infertility. This comes about from the fact that body weight adversely affects the timing of the pregnancy and associated issues such as precocious menarche, and irregular menstrual cycles. Some other issues related that have been identified include early reproductive dysfunction among obese women which include Oligomenorrhea, a type of abnormal uterine bleeding and this results in infrequent or very light menstruation and amenorrhea which is simply defined as the absence of menstrual periods (Pasquali et al., 2003). Obese women are also at a higher risk of infertility and amenorrhea (Rich-Edwards et al., 1994). Women with a BMI over 30, in the Nurses' Health Study, had a 2.7 times higher risk of infertility with those of normal weight

women. Obese women who are treated for their infertility problems at infertility clinics have been found less likely to get pregnant; and if they do become pregnant after in vitro fertilization (IVF) treatment, their risk of early pregnancy loss is greater (Rich-Edwards et al., 1994).

#### ***4.3.1.5.2 Preeclampsia or Pregnancy-induced Hypertension***

Preeclampsia is a major cause of maternal and fetal mortality and morbidity (Confidential Enquiries into Maternal Deaths, 2001). In terms of historical origins, Chesley, Annitto, and Cosgrove, (1968) used the word 'toxemia' to describe what is currently known as preeclampsia. 'Toxemia' is not a preferred term as it can also be used as a broader term to describe various hypertensive disorders that tend to complicate pregnancy.

Preeclampsia is another condition associated with pregnancy related to weight gain which usually manifests during the second half of pregnancy, generally in the latter part of the second or in the third trimesters. It is characterized by high blood pressure associated with a high level of protein in the urine and this may lead to swollen lower and upper limbs. For example, in their meta-analysis of 13 cohort studies, O'Brien and associates found that the risk of Preeclampsia typically doubled if BMI increased by 5 kg/m<sup>2</sup> to 7 kg/m<sup>2</sup>. The same study commented that this increased risk persisted after adjustment for cofounders and exclusion of chronic hypertension and diabetes (Wolf et al., 2001).

The incidence of preeclampsia has been noted to be in the ranges of 2-10%, depending on population contexts and definitions of preeclampsia (World Health Organization International Collaborative Study of Hypertensive Disorders of Pregnancy, 1988). To date, not much literature has been systematically reviewed for factors that predict the relative risk of developing preeclampsia (Duckitt & Harrington, 2005).

In a study by Frederick et al. (2006) involving a group of 1644 pregnant women, researchers evaluated adult weight change, deliberate weight cycling, and pre-pregnancy obesity in relation to preeclampsia risk. Relative to women with stable weight (gained or lost < 2.5 kg) women who gained 5.0-9.9 kg experienced a 2.6-fold increased risk of preeclampsia. The resultant risk ratio for women who gained more than or equal to 10 kg, was 5.1. These results imply that adult weight gain and pre-pregnancy overweight and obesity status are linked with an increased risk of preeclampsia. Fat distribution has been seen to be important in causing preeclampsia than total body fat (Ijuin et al., 1997). In a study involving 22 patients with

preeclampsia and a control group of 126 women, the proportion of upper-body to lower body fat was more precisely related with the development of preeclampsia than was the total body fat (Linne, 2004).

Pregnancy induced hypertension is usually restricted to hypertension in pregnant women who have no preexisting medically defined chronic hypertension or renal diseases and no high blood pressure before a period of two weeks after conception. Another condition is that within this group of women hypertension and proteinuria should be occurring for the first time during the twenty weeks after conception, during labor, and subside after delivery (Zhang, Zeisler, Hatch, & Berkowitz, 1997). These proposals were made by the American College of Obstetricians and Gynecologists (2003) and the National High Blood Pressure Education Program Working Group, (1990) and by the International Society for the Study of Hypertension in Pregnancy (Davey & MacGillivray, 1988).

#### ***4.3.1.5.3 Induction of Labour***

Other issues that have been documented include reduced duration of labour by induction of labour (Doherty, Magann, Francis, Morrison, & Newnham, 2006; Sebire et al., 2001; Sheiner et al., 2004), and also failures in the rate of inductions (Sheiner et al., 2004). Indeed studies have found that obese women also have a higher frequency of induction of labor (Galtier-Dereure et al., 2000). Maternal obesity is associated with greater risk of both intrauterine fetal death and stillbirth with relevance to induction of labour (Myles, Gooch, & Santolaya, 2002). Moreover the rate of caesarean section is more frequent in obese women, (Rode, Nilas, Wojdemann, & Tabor, 2005; Sebire et al., 2001; Sheiner et al., 2004) due to an increased risk of intra-partum complications such as longer operating times, increased blood loss, and infection (i.e. Endometritis) (Mikhail, Walker, & Mittendorf, 2002; Saravanakumar, Rao, & Cooper, 2006; Sebire et al., 2001). This association remains significant even when the procedure is elective and prophylactic antibiotics are administered (Myles et al., 2002). Several studies have shown that obesity is associated with the need for induction of labour (Cedergren, 2004; Doherty et al., 2006; Sheiner et al., 2004). This relationship seems to appear to be of significance even after adjusting complications of pregnancy such as diabetes and hypertension (Robinson, O'Connell, Joseph, & McLeod, 2005). While observing nulliparous women, for every 10 kg increase in body weight, an increase of 0.3 hours in the

interval from oxytocin administration to delivery was noted (Maasilta, Bachour, Teramo, Polo, & Laitinen, 2001).

In a Canadian cohort study by Abenhaim, Kinch, Morin, Benjamin, and Usher, (2007), women with a BMI more than 25 kg/m<sup>2</sup> were found to have a shorter labour duration than those with a BMI less than 25 kg/m<sup>2</sup>. On the contrary, in a study of nulliparous women, cervical dilatation pace was inversely connected with maternal weight: the rate of dilatation decreased by 0.04 cm/hour for every 10 kg increase in weight (Nuthalapaty, Rouse, & Owen, 2004). Likewise, the duration of labour was positively linked with maternal weight (Nuthalapaty et al., 2004). In this research, neither diminished uterine responsiveness nor lower rates of oxytocin administration to heavier women were liable for the slower progress of labour.

However, some studies have cautioned that the duration of labour is generally not significantly different in obese women compared to normal weight women (Reddy et al., 2005). Some studies have shown no effect of obesity status on the duration of the delivery (Galtier-Dereure et al., 2000) while Reddy et al. (2005) reported that the delivery time was longer in obese women.

#### ***4.3.1.5.4 Caesarean Section Delivery, Vaginal Birth after Caesarean Section and Operative Vaginal Delivery***

Obesity has been observed to reduce the likelihood of women succeeding at vaginal birth after caesarian section (Chauhan et al., 2001; Landon et al., 2005), and that obesity is an autonomous risk aspect for an unsuccessful trial of labour after a primary caesarian section (Bujold, Hammoud, Schild, Krapp, & Baumann, 2005; Goodall, Ahn, Chapa, & Hibbard, 2005). In a study concerning over 28000 women, the percentage of failed trial of labour increased from 15% in women of average weight to 22% in overweight women; 30% in obese women; and 39% in morbidly obese women. Other issues included that women diagnosed as morbidly obese were at a drastically greater risk of intra-uterine issues including neonatal injury, rupture, and composite morbidity (Hibbard et al., 2006). Delivery by caesarian section has been shown to occur more frequently in obese women as shown by several studies (Cedergren, 2004; Lu et al., 2001; Ramos & Caughey, 2005; Rhodes, Schoendorf, & Parker, 2003; Rode et al., 2005; Sheiner et al., 2004; Steinfeld et al., 2000; Weiss et al., 2004).

Nevertheless, a high BMI level does not show to increase the risk of requiring an operative vaginal delivery (Abenhaim et al., 2007; Buhimschi, Buhimschi, Malinow, & Weiner, 2004; Callaway et al., 2006; Raatikainen, Heiskanen, & Heinonen, 2006; Ramos & Caughey, 2005; Robinson et al., 2005). A study in the UK (North West Thames study), showed that the odds ratios for operative vaginal delivery among overweight and obese women were 1.04 and 0.95, respectively. Additionally, in another UK population-based group study, obese women had a higher risk of failure during an instrumental delivery, even though they were not at an enlarged risk of wanting an assisted vaginal delivery (Usha, Hemmadi, Bethel, & Evans, 2005). Yet, it appears that the danger of operative vaginal deliveries enhances in women who are obese (BMI > 35 kg/m<sup>2</sup>) or morbidly obese (BMI > 40 kg/m<sup>2</sup>) (Cedergren, 2004; Weiss et al., 2004).

Furthermore, obese women have a higher rate of both planned and acute caesarean sections (Perlow, Morgan, Montgomery, Towers, & Porto, 1992), and the most frequently cited causes tend to be incomplete dilation of the cervix, foetal distress and induction failure. However, it must be noted that the higher rate of caesarean sections seems to be related to the higher rate of complications in the obese women rather than the obesity itself (Perlow et al., 1992). Also, other sorts of assisted delivery mentioned above are more common among obese women. Obese patients have overall a higher risk of complications attributed to surgery. With the higher frequency of caesarean sections come the general risks of surgery in obese patients, that is, thrombosis, infections and vaginal delivery bleeding. The risk for perineal tears is higher in obese women compared to normal weight women (Perlow et al., 1992). This could be because of the higher weight of the child (Reddy et al., 2005). Anesthesia management is another concern for obese women undergoing caesarean sections. For instance, a Canadian study done on 140,000 pregnant women suggested a significant raise in anesthesia complications in women weighing over 120 kg (Arendas et al., 2008).

#### ***4.3.1.5.5 Admission to Neonatal Intensive Care Unit (NICU)***

One of the goals of successful prenatal care with most health care systems is to reduce the numbers of admissions to neonatal intensive care unit. However, obesity studies have indicated that infants born to obese mothers are at increased risk of requiring neonatal intensive care unit admission, although studies once indicated that infants born to obese mothers were not at increased risk of requiring neonatal intensive care unit admission (Rode et al., 2005; Yogeve, Langer, Xenakis, & Rosenn, 2005). Certainly, numerous large retrospective cohort analyses, including the North West Thames study, found children of

obese parturient to be at greater risk of requiring NICU admission than those born to women of normal weight (Arendas et al., 2008). This risk increased as BMI rose (Callaway et al., 2006; Raatikainen et al., 2006). A Canadian group study of over 18,000 pregnancies discovered that women with a BMI more than 25 kg/m<sup>2</sup> were more expected to have their infant admitted to the NICU (Abenhaim et al., 2007).

#### ***4.3.1.5.6 Hemorrhage***

Other complications that have been noted in the perinatal period include complications such as mortality, and increase of hemorrhage risk in obese mothers. Studies such as Abenhaim et al. (2007); Doherty et al. (2006); and Robinson et al. (2005) have reported that as a woman's BMI rises there is increased risk of hemorrhage. In the North West Thames study, the incidence of PPH was 30% higher in overweight women and 70% higher in obese women (Sebire et al., 2001).

#### ***4.3.1.5.7 Gestational Diabetes Mellitus (GDM)***

Gestational diabetes mellitus is defined as glucose intolerance with onset or first recognition during pregnancy (Buchanan, Xiang, Kjos, & Watanabe, 2007). In medical terms this can be defined as a form of hyperglycemia, which is characterized by pancreatic  $\beta$ -cell function that is insufficient to meet the body's insulin needs. Available evidence suggests that  $\beta$ -cell defects in GDM result from the same spectrum of causes that underlie hyperglycemia in general, including autoimmune disease, monogenic causes, and insulin resistance (Buchanan et al., 2007). Obesity has been observed to increase the risk of gestational diabetes mellitus. For example, in a study by Lu et al., (2001), almost 30% of the cases of gestational diabetes seen in their clinic attributed to obesity. Although not integral to the diagnosis, while glucose intolerance normally resolves following pregnancy, it does predict a high risk of type II diabetes mellitus (T2DM) in later life. Therefore, GDM represents an early presentation of T2DM. Within 15 years of pregnancy complicated by GDM, 30% of lean women and 70% of obese women develop T2DM (Buchanan et al., 2007).

Another thing to note is Insulin concentrations are increased and insulin sensitivity is reduced in obese compared with non-obese pregnant women, although these changes are not statistically significant. Obese women are more insulin resistant compared with non-obese women (Yu et al., 2006).

Evidence is also manifested in a study of 16,102 women, which showed a relationship with the increase in being overweight and GDM where the incidence of GDM was 2.3%, 6.3% and 9.5% in the control group, obese group and in the morbidly obese group respectively (Buchanan, Metzger, Fienkel, & Bergman, 1990).

In a UK study, it was also found that women with a BMI greater than 30 kg/m<sup>2</sup> are 3.6 times more likely to develop GDM compared with women with a normal BMI (Sebire et al., 2001). In other words, obesity is the main cause of GDM during pregnancy. In a large Danish study consisting of 8092 women, the odds of developing GDM also increases with BMI (BMI < 25 kg/m<sup>2</sup>, OR 1; BMI 25–29 kg/m<sup>2</sup>, OR 3.4; BMI > 30 kg/m<sup>2</sup>, OR 15.3) (Rode et al., 2005).

Weight loss or change is also an important factor in predicting the likelihood of developing GDM in obese women. For example, women in an observational study who lost 5 kg between pregnancies had a reduced risk of GDM with a relative risk (of 0.63) after altering for maternal age. However, a gain of 5 kg between pregnancies is linked with a bigger risk of GDM (Yu et al., 2006). Hence, pre-pregnancy weight decline and behavioral instruction is of vital importance for these women.

#### ***4.3.1.5.8 Macrosomia, Hyperbilirubinemia and Hypoglycemia***

Other neonatal outcomes that have been studied include Macrosomia, which is birth weight more than 4,500 g, and neonatal hypoglycemia, which is simply defined as a baby who is born with low blood-sugar levels and in medical terms this means plasma glucose less than 40 mg/dl (Hedderson et al., 2006). The early detection of the macrosomic fetus is important to effective prenatal care where this growth abnormality manifests. Although technological improvements such as Ultrasound have been used to effectively detect this, preventable measure such as weight control should be taken to manage this (Hedderson et al., 2006). Another one is called Hyperbilirubinemia, which is a situation where a baby has abnormally high concentrations of the bile pigment bilirubin in the blood stream possibly resulting in jaundice. In medical terms, this is typified by serum bilirubin 20 mg/dl or more (Hedderson et al., 2006). Furthermore, Hedderson et al. (2006) examined whether pregnancy weight gains outside the Institute of Medicine (IOM) recommendations and rates of maternal weight gain were associated with neonatal complications. Adjusting for age, race-ethnicity, parity, plasma glucose screening value, and difference in weeks between delivery and time when last weight was measured, women who gained more than recommended by the IOM were three times

more likely to have an infant with macrosomia but equally likely to have an infant with hypoglycemia or hyperbilirubinemia. The study therefore concluded that maternal weight gain above the IOM recommendations was associated with an increased risk of the outcomes studied. According to Callaway et al. (2006), there is a correlation between increased risk of hypoglycaemia and hyperbilirubinemia but the cause is not known.

#### ***4.3.1.5.9 Urinary Tract Infection***

If participants had dysuria, frequency, or urgency (or all three) and  $\geq 10^2$  colony-forming units of an uropathogen per milliliter of midstream urine they were considered to have a culture-confirmed urinary tract. Moreover, participants had been given a diagnosis of a urinary tract infection by their provider in the absence of a urine culture. In the absence of providing documentation of a urinary tract infection, there was documentation of treatment with a urinary antimicrobial agent (Hooton et al., 1996).

Infection of the urinary tract is a situation where organisms grow within and damage the urinary tract. In clinical practice this is defined in terms of the number of bacteria in a voided urine sample where significant bacteriuria is equal to or greater than ten of the same organism per ml of urine. Symptomatic bacteriuria is defined as equal to or greater than ten (Robertson & Duff, 1988).

One study aimed to show the increased risk of adverse outcomes in labour and fetomaternal morbidity in obese women (BMI >30) and revealed that these women have an increased incidence of urinary tract infection (Usha et al., 2005).

#### ***4.3.1.5.10 Breastfeeding***

Furthermore, an association has been reported between maternal obesity and low breastfeeding rates. Breastfeeding complications occur where the patient is less likely to breast feed and more likely to discontinue. There are so many reasons why maternal obesity tends to be linked to reduced frequency in breastfeeding (Li, Ogden, Ballew, Gillespie, & Grummer-Strawn, 2002). Firstly, there are the obvious mechanical reasons of bending and positioning. Secondly, from an endocrine perspective, obesity is associated with a reduced prolactin response to suckling. It has been observed that the fall in progesterone that occurs immediately postpartum is the trigger for the onset of copious milk secretion, and hence the maintenance of prolactin and cortisol concentrations is necessary for this trigger to be effective (Yu et al., 2006).

Therefore, it can be seen that higher rates of obesity are undermining the health education messages that encourages women to breastfeed. Indeed this is of public health concern because obesity is rising in women of reproductive age and the apparent association with increased artificial feeding will lead to a greater risk of obesity in children (Amir & Donath, 2007).

#### ***4.3.1.5.11 Intrapartum Complications***

More specifically, adverse complications presenting in this group of women include the following. Reproductive disturbances such as menstrual irregularity and problems around ovulation potentially resulting in infertility and miscarriage have been documented. An example of fertility issues was illustrated in one of the largest studies examining the success rate of in Vitro Fertilization which determined that women with BMI > 27kg/m<sup>2</sup> had significantly lower delivery rates than women with a BMI 20kg/m<sup>2</sup> to 27kg/m<sup>2</sup> (Arendas et al., 2008).

Other lifestyle diseases have also been documented to be associated with pregnancy obesity and these include the prevalence of Diabetes Mellitus (Pasquali et al., 2003). Hypertensive Disorders associated with preeclampsia, has also been observed to be four times greater in obese women with a two-fold risk of the development of preeclampsia in subsequent pregnancies (Robinson et al., 2005).

#### ***4.3.1.5.12 Complication on Offspring***

Recent studies have also shown an association between higher maternal weight gain and obesity in the offspring at age 3 (Oken et al., 2007; Olson, Strawderman, & Reed, 2004). Literature searches in all databases and even manual searches yielded no results on issues related to Gulf countries. As has been said earlier on in instances like these, the researcher then resorted to selecting some studies with lessons that could be learnt in the context of Gulf countries. The findings of the studies are summarized in Table 7 page 44. The first study to be used as a starting point in developing study was the one by Olson, Strawderman, and Dennison, (2009) which conducted a Chi-square and logistic regression analyses on a sample of 208 mother-child pairs from an earlier observational cohort study on weight retention. This study is essentially quantitative in paradigm and is based on a US sample where the social determinants differ in many respects with those of Gulf States. In this study it was found that maternal early pregnancy BMI was positively and significantly associated with overweight

offspring. The study further found that the risk of offspring overweight that is associated with 5 excess pounds of net pregnancy weight gain increases with maternal BMI. This study was an observational cohort study of 622 women followed from early pregnancy until two years.

In an effort to find out about socio-economic issues, another study was selected for the reason that it utilized children from lower socio-economic statuses. A retrospective cohort study was conducted on a 8494 sample of low-income children who participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (Nasrat, Fageeha, Abalkhailb, Yamani, & Ardawic, as cited in Ohlin & Rossner, 1990) which showed that maternal obesity in the first trimester of pregnancy doubles the risk of obesity among children between the ages of 2 through 4 years. Data from the National Longitudinal Survey of Youth, (Salsberry & Reagan, 2005) showed maternal pre-pregnancy obesity (BMI  $\geq 30$ ) increased the risk of children, aged 2 through 4 years, having a BMI above the 95<sup>th</sup> percentile by about 40%, compared to children whose mothers had a BMI in the normal range (18.5–24.9).

Another study by Oken et al. (2007) confirmed the fact that greater weight gain was associated with higher child body mass index . The uniqueness of this study was the fact that it utilized such measures as sum of sub scapular and triceps skin fold thicknesses and systolic blood pressure. The study also found that compared with inadequate weight gain, women with adequate or excessive weight gain had children with higher body mass index and were at a risk of being overweight. This study recommended that in light of the child obesity epidemic, the IOM should revise its weight gain guidelines as its current guidelines were made before the obesity epidemic was not as high as it is now. Although this study was conducted in a developed country, caution must be taken not to generalize it to a developing country. Another caution to be taken is that in this study one third were born to mothers who smoked during pregnancy.

#### **4.3.1.5.13 Other Complications**

It is therefore recommended that the preference will be not to exceed these limits in weight gain as this might lead to a number of complications in pregnancy and delivery. Some of them could be high blood pressure, fatigue, backache, delivery complications due to increased fetus weight and less milk secretion due to the high storage of fat tissues around the milk glands. Resuscitation including mechanical ventilation appears more likely to occur in infants of obese women (i.e. with a BMI > 30kg/m<sup>2</sup>) (Doherty et al., 2006). Additionally, there is an

increased death in the neonatal period in infants born to obese mothers (Sebire et al., 2001; Wolf et al., 2001).

Another issue that has been documented is that of multiple births. For example, the obesity cause of increased incidences of multiple births has been explained by the relationship between increased BMI and incidence of twinning. Scientifically this can be explained may be by the finding of increased levels of FSH in a group of women with BMI greater than 30kg/m<sup>2</sup> (Fedorcsak et al., 2004).

#### **4.4 Triangulation of Findings**

Triangulation was only made with either the developed world or the Gulf countries with similar socio-cultural environments. The developed world was chosen because of the assumed quality care.

The most relevant study to be detailed here is one by Sebire et al, (2001) who reported a number of risks to be outlined below. The major finding of this study was that obese women tend to have negative outcomes in gestational diabetes mellitus, delivery emergence by caesarian section, genital tract infection, urinary tract infection, birth weight issues, and intrauterine death. This study utilized 287,213 pregnancies in almost all areas of London, of which 110,290 were obese and the remainder considered non-obese. However the results of this study were not conclusive about issues identified in other studies, which are delivery before 32 weeks of gestation and breastfeeding at discharge. It is noted that these complications are reported in a study conducted in a developed world with a comparatively well functioning health system. This therefore may suggest that even with adequate prenatal care obesity can still lead to negative pregnancy outcomes. Another observation could be that in developing countries like the Gulf countries the risks could be worse. Yet another important thing to note is that 73% of the subjects in this study were Caucasians and when this study is being compared with other ethnic communities it must be noted that there are other social determinants that can lead to risks and non-risks.

One can conclude that although the studies above have identified risks related to outcomes on pregnancy overall maternal care can also determine pregnancy outcome risks. Therefore, since the studies were carried out in countries with different health care systems caution must be taken in looking at the transferability of these findings.

#### **4.4.1 Obesity reduction interventions**

This section used studies from non- Gulf countries and reviewed articles which contain transferable knowledge from other contexts to answers the fourth question, what are the ways in which the identified issues could be addressed to reduce obesity and its complications for Arabian Gulf women?

Cedergren (2004) used a case-control intervention study which demonstrated that it is possible to reduce the prevalence of excessive gestational weight gain through clinical and patient education interventions (Abrams et al., 2000; Olson, Strawderman, Hinton, & Pearson, 2003). Recently two other teams have shown this to be possible in obese women (Wolff, Legarth, Vangsgaard, Toubro, & Astrup, 2008).

Pregnant women may be especially motivated to make lifestyle changes out of concern for the health of their offspring (Crittenden, Manfredi, Lacey, Warnecke, & Parsons, 1994; Herzig et al., 2006). This is strength that could be capitalized on especially considering the behavior change theories that focus on willingness to change behavior. The Institute of Medicine's (IOM) guidelines for weight gain during pregnancy are widely accepted and endorsed by the American College of Obstetricians and Gynecologists (ACOG) and other professional organizations worldwide. In a study of pregnant women receiving prenatal care in the San Francisco Bay Area, one third of surveyed subjects reported receiving no advice from providers on how much weight to gain during pregnancy (Stotland et al., 2005). In a study among overweight and obese primary care (non-pregnant) patients, most patients wanted weight-related counseling from their doctor, yet less than half of the obese subjects and only 24% of the overweight subjects had discussed weight issues at their primary care visit. Twenty eight studies of prenatal care patients have been undertaken to assess women's preferences for style and content of weight gain counseling in pregnancy (Potter, Vu, & Croughan-Minihane, 2001).

This study which in traditional systematic review might not been seen as being of high quality as this is a qualitative systematic review. The study sought to identify and characterize barriers to weight gain counseling and describe the chosen populations' subject's counseling techniques and strategies. One study which conducted seven focus groups of prenatal care providers between July 2007 and February 2008 included participants from a variety of practice settings in the San Francisco Bay Area (American College of Obstetricians and Gynecologists, 2003). An important recommendation from the study by the American College

of Obstetricians and Gynecologists, (2003) was the development of the Guidelines for Parental Care and advises clinicians to provide nutritional counseling and weight gain recommendations according to the Institute of Medicine of the National Academies (2009) to all pregnant women. The data suggested that providers face many barriers in meeting this standard of care.

Secondly, the study found that the providers in the study often wait for cues from the patient to address weight gain issues, a phenomenon we call a “reactive” rather than a “proactive” approach to assessment and counseling (American College of Obstetricians and Gynecologists, 2003). Some providers avoided or delayed weight gain counseling for fear of shaming, stigmatizing, or causing anxiety in the patient. The reactive approach to counseling seems to arise, in part, from the perception that weight is a sensitive topic for patients and providers alike. This will be a good starting point for capitalizing on values in the Arabian Gulf countries population as with some sectors of the society weight gain issues are not as sensitive as they are in Western countries. The study found that ideally, the initial prenatal assessment should include the patient’s knowledge, attitudes, and behaviors about weight and food, incorporating family and cultural influences, past experiences, and willingness to change behavior (American College of Obstetricians and Gynecologists, 2003).

Another prospective case-control study (Olson et al., 2004) introduced the use of two major intervention strategies of counseling and physical activity among 150 women respondents in a control group. Another important thing about this study is that it was done in a setting that is said to have a comparatively good maternal health system which reaches 100% of all pregnant mothers. The findings of this study suggested that the intervention resulted in a significantly lower weight gain during pregnancy and at the postnatal check-up among women in the intervention group compared with the control group. The strength of this study was mainly in the fact that it factored in the socio-demographic factors such as employment status and education status. The study (Olson et al., 2004) mainly focused on one socio-economic status group, and looked on low-income women and found that those who received the intervention had a significantly reduced risk of excessive gestational weight gain. Overweight women within this income subgroup were at significantly reduced risk of retaining more than 2.27 kg. However, it appeared that the intervention appeared to reduce the risk of excessive gestational weight gain only in the low-income subgroup. Hence, this shows that there are still a lot of interventions to be trialed before conclusions are made about the efficacy of such interventions.

#### **4.4.2 Triangulation of intervention**

All the above studies were triangulated (cross-referenced) with findings from a randomized trial of the effects of dietary counseling on gestational weight gain and glucose metabolism in obese pregnant women (Wolff et al., 2008). With the strength being its randomized design, such study intensively monitored weight development and repeated measures of insulin, leptin, and glucose. The study aimed to examine whether gestational weight gain in obese women can be restricted by 10-h dietary consultations and whether such a restriction can impact the pregnancy-induced changes in glucose metabolism. One important feature of this study was the significant role played by dietitians in the consultation about weight loss. While many studies have emphasized the role of obstetricians, this study was one of the few that emphasized the role of other health professionals such as dietitians. Another feature of this study was its specificity, meaning that while other studies emphasize weight reduction this one allowed weight gain to go up by 6-7kg. This study also made the intervention that followed the weight gain guidelines set as national studies for a Danish population. Firstly, the study found that the intervention group limited their overall gestational weight gain to an average of 6.5 kg, whereas the control group had an average gain of 13.75kg. Secondly, the study found that the weekly average weight gain starting from inclusion to 36 weeks of conception decreased notably by 0.18 kg per week (0.07–0.30, p=0.02) in the intervention group compared to the control group. Thirdly, this study found that the intervention group maintained 6.9 kg less weight than the control group compared to the pregnancy weight. With these findings, bearing in mind the strengths of this study, it can be seen that indeed interventions may help reduce the pregnancy induced obesity epidemic.

## **Chapter five: Discussion and Conclusion**

### **5.1 Discussion and Conclusion**

This study began by giving a background of the countries selected for the issue being studied. The background also consisted of general scientific knowledge about pregnancy and obesity issues including social determinants and pathophysiological factors. The methodology set out the modified systematic review as the process and general literature review process. The results were then discussed and the conclusion follows. To reiterate, this dissertation has four research questions:

1. What is the prevalence of obesity among pregnant women in Gulf countries?
2. What the role of economic, social, behavioural, and lifestyle factors associated with obesity among pregnant women in Gulf countries?
3. What evidence is available about the pregnancy complications related to obesity among pregnant women?
4. What are the ways in which the identified issues could be addressed to reduce obesity and its complications for Arabian Gulf women?

Firstly, it can be seen that in terms of methodology, this research process followed a modified systematic review process, which has its strengths. Therefore, the conclusion drawn from this process should be evaluated in qualitative ways as opposed to scientific ways. The scientific ways should be viewed as alternatives to bring other views as opposed to being seen as standards for critiquing this work. Secondly, it is apparent from the emerging studies that the evidence available that can be utilized in Gulf countries is mainly from other countries, especially the western countries. While such evidence is invaluable especially in a setting where the problem is growing but with little research done, it is important that such evidence is used with caution or leaves room to account for differences and similarities in culture and economic development. Another study addressed the factors of prevalence has been researched a lot in the Arabian Gulf context but at the same time measures or determinates of complications during pregnancy have not been done.

The following is a summary of results related to research question one - Prevalence of Obesity among pregnant women in Gulf Countries. Results of studies in obesity prevalence in

Arabian Gulf Countries have shown that Kuwait has the highest prevalence at 46% of the population, the lowest being 34.9% in Bahrain. The obesity prevalence in Saudi Arabia is 35.6%. As Gulf countries share social, economic and cultural similarities, it is logical to argue there could be similarities in the social determinants of obesity among women, and pregnant women. In developing countries, particularly Muslim countries, population prevalence studies are difficult, particularly for women as it is difficult to locate a representative sample from willing participants thus, cross referencing information is important.

Obesity was found to be prevalent in 35% females in UAE. Sample data could be extrapolated to the female population of the city and possibly to the urban female population in the UAE. With such high prevalence, predictive studies are important in planning for the needs of pregnant women with regards to obstetric care. In Bahrain, obesity is reported as more prevalent among women. Further, it was reported the prevalence of obesity in women to be up to 80% in 1995. A marked increase from 39% as recorded in 1980. Bahrain's diabetes prevalence, usually associated with obesity has been documented as one of the highest in the world. The issue of obesity among pregnant women in Gulf countries is on the increase alongside modernization trends. Obesity prevalence trends seem to be consistent in Gulf Countries.

Results relating to research question two, the role of economic, social, behavioural and lifestyle factors associated with obesity among pregnant women in Gulf countries are summarized and discussed as follows. The material covered in the literature review uncovered nine key factors directly associated with or relevant to obesity among pregnant women in Gulf countries. Socio-economic, socio-cultural, psychosocial and emotional, age, body image, nutritional quality, economic shifts, education, and lifestyle choices emerged as key factors in the studies reviewed.

Affluence has been cited as a factor that increases obesity among pregnant women in Gulf countries. Particular combinations of biological and social determinants such as sex, age, marital status, lifestyle, smoking and eating habits appear to be associated with obesity. Psychosocial and emotional factors result in poor nutrition or overeating and snacking. Age also appears a factor in relation to marital status and body image. The economic shift of the countries towards the end of the 1990's has caused a number of negative lifestyle changing trends with regard to an increase in sedentary lifestyles, recreation and employment conditions. It has also caused change in nutritional habits, with an increase in consumption of low quality but highly processed foods. Conversely, a rise in economic status enables access

to higher quality nutrition. Education and socio-economic status in urban contexts, have been noted to decrease obesity prevalence through access to information and a higher awareness of body image, particularly due to western influence. Although in rural areas, higher socio-economic levels caused rise in obesity prevalence. Obesity has a higher prevalence in low socio-economic and low educated groups whose limitations lead them to engage in less expensive, inactive pass times.

As part of the Saudi community, I am aware there are several cultural factors and traditional cultural norms with regard to pregnant women that can increase the likelihood of obesity that have not been addressed in the academic literature. For example, in terms of values and social expectations, Saudi mothers are not expected to work throughout motherhood. In addition to this, there is also a cultural tradition in Gulf countries that mothers are expected to take 40 days of bed rest or confinement followed by maternity leave for up to two years. In countries such as New Zealand, parents risk losing their jobs if they are out of the work-force for too long, whereas in the Arabian Gulf countries, tradition dictates that during this period an Arabian Gulf husband is expected to be the provider for their families. This impacts significantly on physical activity levels of these women.

The following discusses and summarises the complications pertaining to research question three – Pathophysiological issues associated with obesity during pregnancy. There are many pathophysiological issues or risks associated with obesity during pregnancy. These are cause for concern and measures must be taken to avoid them for the wellbeing of the mother and child. In summary, obesity complicates fertility, pregnancy and the health of the both the mother and child during and after birth.

Obesity is associated with infertility as body weight affects the timing of the menstrual cycle. It can cause Oligomenorrhea and even amenorrhea. Obese women involved with IVF treatment are less likely to become pregnant and face risks of early pregnancy loss.

Preeclampsia is a major cause of maternal and fetal mortality and morbidity. The condition is characterized by hypertension and proteinuria; results link the condition to adult weight gain and pre-pregnancy obesity. A reduced duration of labour and preterm delivery is brought about through obesity, as is the increased need for induction and caesarian delivery. Obese women have an increased risk associated with intra-partum complications related to surgery, such as increased blood loss, intra uterine issues such as rupture, infection risks and complications related to anesthesia. There is a high incidence of urinary tract infection with

related complications and an increasing risk of perinatal hemorrhage as BMIs increase. Gestational diabetes mellitus, a form of hyperglycemia is a risk for pregnant obese women, and this increases the risk of the development of Type II diabetes mellitus in later life.

Infants born to obese mothers face an increased risk of requiring neonatal intensive care, the risk increasing the higher the mother's BMI. Macrosomia, hyperbilirubinemia and hypoglycemia are conditions affecting the fetus and newborn which are risks associated with obesity in pregnancy. An association with maternal obesity and low breastfeeding rates has been observed causing issues for the health of the newborn.

The following is a summary and discussion regarding to research question four – What are the ways in which the identified issues could be addressed to reduce obesity and its complications for Saudi women? The ways have been identified from intervention studies conducted in other countries as to how best to reduce obesity in pregnant women. A variety of studies have shown reticence in both patient and health care providers in addressing issues around weight retention and gain. The IOM guidelines for weight gain during pregnancy are widely accepted and endorsed by health professionals. While there is a sense that intervention is necessary, there is a discrepancy in the interventions conducted and offered. It was noted that pregnant women may be especially motivated to make lifestyle changes out of concern for the health of their offspring. This motivation is important and studies have recommended this be capitalized upon in order to engender change in the weight related profiles of patients. There is a need for health care providers to take a proactive stance on weight gain issues, rather the more common reactive approach. Some providers avoided or delayed weight gain counseling to avoid causing embarrassment or anxiety in the patient. It was documented that a reactionary stance was taken where there is a perception of weight related issues being sensitive, for that of the patient and the provider. It was recommended that prenatal assessment should include a full discussion around the patients' perception of weight related issues and behaviors and to provide means to correct any weight related issues. The problem arising seems to be around communication and implementation of interventions in order to ensure women are receiving the appropriate information, prior to pregnancy. Furthermore, it was noted there must be more work done on the efficacy of a variety of weight related interventions in order to achieve the required reduction rates across all social groups.

The above findings were cross-referenced from a randomized trial on the effects of dietary counseling on gestational weight gain. After monitoring weight development and measuring insulin, leptin and glucose, it was investigated whether gestation in obese women can be

restricted in 10-h dietary consultations. Whether such a restriction can impact the pregnancy-related changes in glucose metabolism was investigated. The role of dietitians in weight loss consultation factored highly in the study, rather than solely the role of obstetricians. Also, this dissertation followed interventions for weight gain guidelines for the Danish population. It found the intervention group saw gestational weight gain to an average of 6.5kg, as opposed to that of 13.7kg in the control group. The average weekly weight gain was significantly reduced by 0.18 kg per week (0.07–0.30,  $\frac{1}{4}0.02$ ) in the intervention group compared to the control group. Finally, the dissertation found the intervention group retained 6.9 kg less than the control group, when compared to the pregnancy weight. The study demonstrates the plausibility of the correct intervention in assisting the reduction of pregnancy induced obesity.

In conclusion, overweight and obesity have reached epidemic proportions in Arabian Gulf countries and are threatening to become a global epidemic. Excess weight has a great impact on the health and quality of life of individuals. This dissertation found there are risk factors related to obesity among pregnant women in the Arabian Gulf countries, such as economic, social, behavioral, and lifestyle during pregnancy. Also, this dissertation explains the complication of obesity among pregnant mothers in relation to many diseases which are related to obesity during pregnancy. Finally, this dissertation includes the intervention strategies to reduce obesity among pregnant women in the Arabian Gulf countries.

## **5.2 Recommendations**

As I am from the Kingdom of Saudi Arabia, I view the findings from this dissertation as very important. It will serve to reduce the risks of obesity during pregnancy to women in my community as I can help to provide an understanding and inform the society about these issues. Consequently, this may help reduce obesity during pregnancy in the Kingdom of Saudi Arabia and the neighbouring countries.

As has been seen in the search for literature about complications related to pregnancy, there is lack of knowledge about specific risk factors in Gulf countries. Much of the available evidence is transferred from studies done in other settings. This happens despite much evidence pointing to the strength of the role of social determinants in the complications among pregnant obese women. It is therefore recommended that research built on a broader Gulf states' context be prioritized. Such evidence base will inform the Gulf countries health promotion authorities' strategies.

The strength of evidence pointing to social determinants, in both prevalence and pregnancy related complications of obesity, shows the need for multiple approaches to address the problem. Specifically, this would mean employing strategies such as building:

- Community strength
- Policy oriented strategies
- Educational strategies

Another important area is that the issue of obesity in Arabian Gulf countries is growing in prevalence in the younger population and the older population is already living with this morbidity. In terms of approaches to primary health care, it is hereby suggested that both preventive and curative strategies must be adopted to cater for both the population not yet affected and the one that has already been affected.

I recommend better counseling tools as the most helpful clinical resource for obesity management. Also;

- The adaptation of and validation of a brief assessment tool, such as those used for smoking and alcohol counseling might improve counseling behaviors.
- Due to the apparent urgency of the need to curb obesity in Gulf countries there is a need for a multi-stakeholder (community around the pregnant mothers) approach so that the problem is approached from different angles. A recommendation for multi-stakeholder approach follows the evidence that in some countries obstetricians are not comfortable to provide counseling services to pregnant women or they do not see this as their primary roles.

### **5.3 Limitations of the Study**

While the study articulated most of the issues including offspring related ones with regards to obesity and pregnancy complications, it must be noted that some of the weight gain issues also continue to the postpartum period. The limited nature of the study did not permit much broader understanding of issues related to obesity during post-partum.

### **5.4 Future Research**

Studies of prenatal care patients are needed to assess Arab Gulf women's' preferences for style and content of weight gain counseling in pregnancy. In terms of approaches to weight gain counseling in pregnancy, evidence from recent clinical trials suggests that weight gain

can be modified by prenatal counseling (Alexander & Korenbrot, 1995). Although this may be correct in European countries, such evidence needs to be looked at in the context of the Gulf countries. Most of the studies reviewed were observational and there is a compelling need to conduct experimental studies. One major issue identified in the research was that the majority of obesity related studies in the Arabian Gulf countries tend to focus on prevalence, and while this may be important in making policy makers aware of the scale of the issue the researcher hereby suggests more specific research on aspects of obesity such as appropriate interventions. In addition to the above gap, it can be seen from the intervention studies that there was a gap in terms of literature articulating culturally appropriate interventions. Since Gulf countries possess distinct culture, it will be useful for research to focus on the effectiveness or the need for culturally appropriate intervention strategies.

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