Review of literature

(1)

Obesity

The increasing prevalence of overweight and obesity among young women in most countries underlines its large potential impact on adverse pregnancy outcome ***(Heslehurst N et al, 2009).***

During pregnancy, maternal overweight/obesity increases the risk of serious complications, such as gestational diabetes, hypertension and pre-eclampsia , which lead to increased risk for preterm birth (PTB) , reduced or augmented fetal growth and stillbirth ***(Andreasen KR et al , 2007).***

Obesity is a significant health issue for women during pregnancy and the puerperium. It is well recognized that maternal obesity is associated with an increased risk of maternal, antenatal, per partum and neonatal complications ***(Callaway L et al, 2006).***

Obesity not only has direct implications for the health of the pregnancy but also impacts on the weight of the child in infancy and beyond ***(Birdsall KM et al, 2009).***

In 2002, ***Cnattingius et al*.** warned that overweight and obesity, because of their increasing prevalence could parallel smoking as a contributor to the occurrence of adverse pregnancy outcomes. However, no quantitative comparisons have yet been published.

Obesity, defined as abnormal fat accumulation that leads to excessive body weight, is commonly classified based on the body mass index (BMI) values, defined as the weight in kilograms divided by the square of the height in meters (kg/m^2) **(WHO).**

The body mass index (BMI), or" Quetelt index", is a statistical measure which compares a person's weight and height. Though it does not actually measure the percentage of body fat, it is used to estimate a healthy body weight based on a person's height. Due to its ease of measurement and calculation, it is the most widely used diagnostic tool to identify weight problems within a population, usually whether individuals are underweight, overweight or obese. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing social physics ***(Eknoyan & Garabed 2008)***. Body mass index is defined as the individual's body weight divided by the square of one's height. The formulae universally used in medicine produce a unit of measurement of kg/ m^2. BMI can also be determined using a BMI chart ***(National Institutes of Health)*** which displaces BMI as a function of weight (horizontal axis) and height (vertical axis) using contour lines for different values of BMI.

Body Mass Index (BMI) Chart for Adults

Obese (>30) | Overweight (25-30) | Normal (18.5-25) | Underweight (<18.5)

HEIGHT in feet/inches and centimeters

¡HT	4'8"	4'9"	4'10"	4'11"	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	6'5"
kg)	142cm		147	150	152	155	157	160	163	165	168	170	173	175	178	180	183	185	188	191	193	196
117.9)	**58**	**56**	**54**	**53**	**51**	**49**	**48**	**46**	**45**	**43**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**32**	**31**
115.7)	57	55	53	51	50	48	47	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30
113.4)	**56**	**54**	**52**	**50**	**49**	**47**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**
111.1)	55	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	31	31	30	29
108.9)	**54**	**52**	**50**	**48**	**47**	**45**	**44**	**43**	**41**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**33**	**32**	**31**	**30**	**29**	**28**
106.6)	53	51	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	29	29	28
104.3)	**52**	**50**	**48**	**46**	**45**	**43**	**42**	**41**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**
102.1)	50	49	47	45	44	43	41	40	39	37	36	35	34	33	32	31	31	30	29	28	27	27
99.8)	**49**	**48**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**34**	**33**	**32**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**
97.5)	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	28	28	27	26	25
95.3)	**47**	**45**	**44**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**28**	**27**	**26**	**26**	**25**
93.0)	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	29	28	27	26	26	25	24
90.7)	**45**	**43**	**42**	**40**	**39**	**38**	**37**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**
88.5)	44	42	41	39	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	23
86.2)	**43**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**	**23**	**23**
83.9)	41	40	39	37	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22
81.6)	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**
79.4)	39	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21
77.1)	**38**	**37**	**36**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**
74.8)	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	20
72.6)	**36**	**35**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**	**19**	**19**
70.3)	35	34	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	18
68.0)	**34**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**
65.8)	33	31	30	29	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	17
63.5)	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**17**
61.2)	30	29	28	27	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	16
59.0)	**29**	**28**	**27**	**26**	**25**	**25**	**24**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**
56.7)	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	16	15	15
54.4)	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**
52.2)	26	25	24	23	22	22	21	20	20	19	19	18	17	17	16	16	16	15	15	14	14	14
49.9)	**25**	**24**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**
47.6)	24	23	22	21	21	20	19	19	18	17	17	16	16	16	15	15	14	14	13	13	13	12
45.4)	**22**	**22**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**14**	**13**	**13**	**12**	**12**	**12**
43.1)	21	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11
40.8)	**20**	**19**	**19**	**18**	**18**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**12**	**11**	**11**	**11**
38.6)	19	18	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10
36.3)	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**11**	**11**	**11**	**11**	**10**	**10**	**10**	**9**

l values rounded to the nearest whole number. BMI categories based on CDC (Centers for Disease Control and Prevention) criteria.

rtex42.com BMI = Weight[kg] / (Height[m] x Height[m]) = 703 x Weight[lb] / (Height[in] x Height[in]) © 2009 Vertex42 LLC

Figure (1): **Body Mass index Chart for Adults. (WHO).**

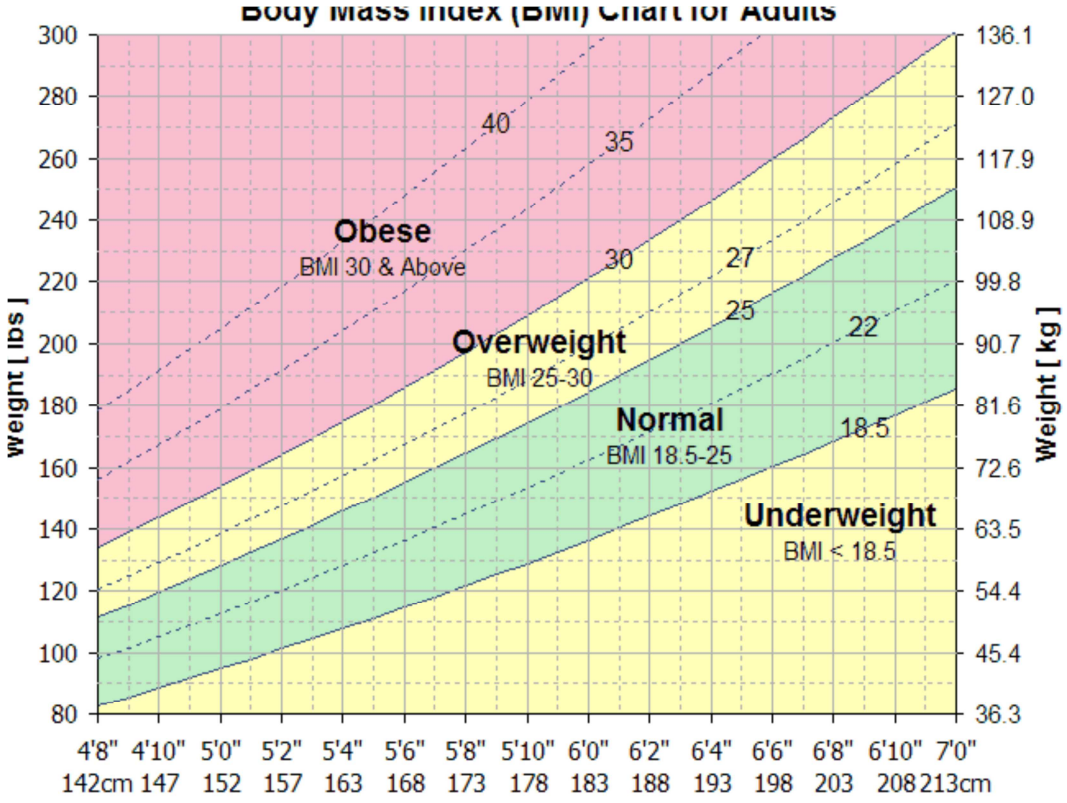

Figure (2): **Body Mass index Chart for Adults. (WHO)**

Applications:

The Body Mass Index is generally used as a means of correlation between groups related by general mass and can serve as a vague means of estimating adiposity. The quality of the Body Mass Index is that, whilst easy - to -use as a general calculation, it is limited in how accurate and pertinent the data obtained from it can be.

Generally, the Index is suitable for recognizing trends within sedentary or overweight individuals because there is a smaller margin for errors ***(Jeukendrup, Gleeson, 2005)***.

Factors influencing obesity:

Obesity is not a single disorder but a heterogeneous group of conditions with multiple causes. Body weight is determined by an interaction between genetic, environmental and psychosocial factors acting through the physiological mediators of energy intake and expenditure. Although genetic differences are of undoubted importance, the marked rise in the prevalence of obesity is best explained by behavioral and environmental changes that have resulted from technological advances.

A) Genetics:

Fatness runs in families but the influence of the genotype on the etiology of obesity may be attenuated or exacerbated by non genetic factors. Apart from rare obesity-associated syndromes, the genetic influences seem to operate through susceptibility genes. Such genes increase the risk of developing a characteristic but are not essential for its expression or, by themselves, sufficient to explain the development of a disease. The susceptible-gene hypothesis is supported by findings from

twin studies in which pairs of twins were exposed to periods of positive and negative energy balance ***(Bouchard,C et al 1990).***

B) Environmental factors:

The current epidemic of obesity is caused largely by an environment that promotes excessive food intake and discourages physical activity. Although humans have evolved excellent physiological mechanisms to defend against body weight loss, they have only weak physiological mechanisms to defend against body weight gain when food is abundant. Control of portion size, consumption of a diet low in fat and energy density, and regular physical activity are behaviors that protect against obesity, but it is becoming difficult to adopt and maintain these behaviors in the current environment. Because obesity is difficult to treat, public health efforts need to be directed toward prevention ***(James O.Hill and John C. Peters 1998).***

C) Energy Expenditure:

The most variable component of energy expenditure is physical activity, representing 20-25% of total energy expenditure. The analysis of the level of physical activity is similar levels of habitual activity is similar in groups of subjects with a BMI of <20, 20-25 and 25-35, which indicates similar levels of habitual activity. The measurement of energy expenditure within the home shows comparable values between obese and lean subjects when corrected for different body sizes ***(Prentice , A. M.. et al 1996).***

D) Energy intake:

It is surprising that no direct correlation has been reported between the prevalence of obesity and increased energy intake in developed nations, given the ready availability of highly palatable foods. The understanding of the role of energy intake in the etiology of obesity is confounded by failure to report food intake accurately. Under-reporting is widely recognized as a feature of obesity, with comparisons of energy intake and expenditure in obese subjects showing a consistent shortfall in self-reported food intake of approximately 30% of the energy requirements ***(Lichtman S. et al. 1993) and (Poppitt S. D. et al 1998).***

E) Culture:

Evidence for the critical role of environmental factors in the development of obesity comes from migrant studies and the" westernization" of diet and lifestyles in developing countries. The pronounced increase in age- standardized prevalence of obesity (>60% in men and women) in the Naurians in Micronesia and Polynesians in Western Samoa is closely paralleled by alterations in diet and lifestyle ***(James, W 1996).***

F) Psychological Factors:

Psychological factors may also influence eating habits. Many people eat in response to negative emotions such as boredom, sadness, or anger.

Most overweight people have no more psychological problems than people of average weight. Still, up to 10 percent of people who are mildly obese and try to lose weight on their own or through commercial weight loss programs have binge eating disorder. This disorder is even more common in people who are severely obese.

During a binge eating episode, people eat large amount of food and feel that they cannot control how much they are eating. Those with the most severe binge eating problems are also likely to have symptoms of depression and low self-esteem.

These people may have more difficulty losing weight and keeping it off than people without binge eating problems.

If you are upset by binge behavior and think you might have a binge eating disorder, seek help from a health professional such as a psychiatrist, psychologist, or clinical social worker.

Individuals seeking treatment for weight loss have consistently demonstrated a higher prevalence of distress than their non treatment-seeking counterparts. For instance, it has been found that obese treatment seekers show elevated levels of depression and Body-image distress ***(Cash T F 1993) and (Goldsmith SJ et al 1992).***

Most obstetrical caregivers record prepregnancy weight in the antenatal record, although documentation of maternal height is inconsistent ***(Robinson HE et al,2005).***

Recent evidence from the United States suggests that many obstetrician- gynecologists use BMI data to screen for obesity ***(Power M,et al ,2006).***

The identification of women at risk is not routinely followed by interventions. Suggested strategies include behavioral weight loss treatments and specific counseling regarding exercise, diet, and pregnancy weight gain. ***(Power M,et al ,2006).***

WEIGHT GAIN IN PREGNANCY

Women should set pregnancy weight gain goals based on their pre-pregnancy BMI as shown in Table 1.

Pre-pregnancy BMI (kg/m2).	**Rate of gain 2nd and 3rd trimester (kg/week)*.**	**Recommended total gain range (kg).**
Less than 18.5	0.45	12.5 to 18
18.5 to 24.9	0.45	11.5 to 16
25.0 to 29.9	0.28	7 to 11.5
Greater than or equal to 30.0	0.22	5 to 9

* Calculations assume a 0.5-2 kg weight gain in the first trimester.

Table 1. Pregnancy weight gain based on BMI (Cunningham FG et al, 2001)

To achieve these goals women should be at the healthiest weight possible when they enter pregnancy.

During well-woman checks and other health care interactions, non-pregnant women of child-bearing age can be advised of their BMI. An evaluation of dietary intake and exercise habits can provide insight into women at risk (***Handbook for physical activity guide to healthy active living. Ottawa: Health Canada; 1998).***

According to the joint guidelines on exercise in pregnancy by the Canadian Society for Exercise Physiology, all pregnant women without contraindications should participate in regular exercise. ***(Davies GAL et al, 2003)***.

During prenatal visits women can be questioned and advised about their diet and exercise habits. Where available, nutritional counseling can be a helpful adjunct for women not meeting the weight gain guidelines in Table 1***.***
(Piirainen T,et al,2006).

Pregnancy outcomes are related to maternal weight gain, also depending on pre-pregnancy BMI, these pregnancies were at increased risk of macrosomia "Fetal weight> 4000 g", augmentation of labor, gestational hypertension, and neonatal metabolic abnormalities.

Regardless of BMI, those women who gained the recommended amount of weight in pregnancy had fewer adverse outcomes (Caesarean section, gestational hypertension, birth weight < 2500 g or> 4000 g) ***(Crane JMG et al, 2009).***

The prevalence of overweight /obesity has rapidly increased in recent years among young people. It already parallels smoking in its impact on the occurrence of adverse pregnancy outcomes. As smoking is an established risk factor for pregnancy outcomes, multiple prevention and education programmes have been organized, leading to a decrease of its prevalence among pregnant women. In the future, similar efforts are needed to develop and implement effective methods for the prevention of overweight and obesity among young women ***(Cnattingius et al, 2002).***

Obstetric complications of maternal obesity are generally related to pre-pregnancy obesity although excessive weight gain during pregnancy is also implicated. The degree of relative risk of complications is directly related to the level of obesity. ***(Catalano PM., 2007)***

Health risk	***Increasing BMI associated with increased risk of:***
Preconception	• Infertility.
Antenatal	• Ante partum stillbirth.
Medical	• Maternal mortality. • Diabetes (Gestational and Type 2). • Eclampsia. • Obstructive sleep apnea-may be related to adverse fetal outcomes. • Thromboembolic disease. • Cholecystitis. • Depression.
Peripartum monitoring	• Difficulties obtaining adequate auscultation of fetal heart and cardiotocograph (CTG). • Suboptimal ultrasonography.
Anesthetic	• Increased failure of epidural analgesia during labor.