EFFECT OF BODY WEIGHT ON PREGNANCY OUTCOME

Dissertation submitted in

Partial fulfillment of the regulations required for the award of

M.S. DEGREE

In

OBSTERTICS AND GYNAECOLOGY

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

Reg. No : 221216451

APRIL – 2015

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Certificate

CERTIFICATE

This is to certify that the dissertation titled **"EFFECT OF BODY WEIGHT ON PREGNANCY OUTCOME"** is an original work done by **Dr. Aishwarya M Reddy** PG student, PSG Institute of Medical sciences and Research, Coimbatore, under my supervision and guidance.

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DECLARATION

I solemnly declare that this dissertation **“EFFECT OF BODY WEIGHT ON PREGNANCY OUTCOME”** was written by me in the Department of Obstetrics and Gynaecology, PSG Institute of Medical sciences & Research, Coimbatore, under the guidance of **Dr. Latha Maheswari.S,** DGO., DNB Professor Department of Obstetrics and Gynaecology, PSG Institute of Medical sciences & Research, Coimbatore.

This dissertation is submitted to the Tamil Nadu Dr. M. G. R Medical University, Chennai in partial fulfillment of the university regulations for the award of degree of M.D Obstetrics and Gynaecology examinations to be held in April 2015.

Place: Coimbatore **Dr. Aishwarya M Reddy**

Date:

Acknowledgement

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With a deep sense of gratitude I acknowledge the help rendered by my co – Post Graduates.

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I thank my family for being my pillar of strength.

I am highly indebted to the patients who consented to be the source of my study, without whom the whole study would have been impossible.

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September 19, 2013

To
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The Institutional Human Ethics Committee, PSG IMS & R, Coimbatore -4, has reviewed your proposal on 21st June, 2013 in its expedited review meeting held at College Council Room, PSG IMS&R, between 2.00 pm and 3.30 pm, and discussed your study proposal entitled:

"Effect of body weight on pregnancy outcome"

The following documents were received for review:

1. Duly filled application form
2. Proposal
3. Informed Consent Form (Tamil Ver. 1.1)
4. Informed Consent Form (English Ver. 1.1)
5. Data Collection Tool
6. Budget
7. CV

After due consideration, the Committee has decided to approve the above study.

The members who attended the meeting, at which your proposal was discussed, are listed below:

Name	Qualification	Responsibility in IHEC	Gender	Affiliation to the Institution Yes/No	Present at the meeting Yes/No
Dr P Sathyan	DO, DNB	Clinician, Chairperson	Male	No	Yes
Dr S Bhuvaneshwari	M.D	Clinical Pharmacologist Member - Secretary	Female	Yes	Yes
Dr Sudha Ramalingam	M.D	Epidemiologist Alt. Member - Secretary	Female	Yes	Yes
Dr D Vijaya	Ph D	Member – Basic Scientist	Female	Yes	Yes
Dr Y S Sivan	Ph D	Member – Social Scientist	Male	Yes	Yes

The approval is valid for one year.

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We request you to intimate the date of initiation of the study to IHEC, PSG IMS&R and also, after completion of the project, please submit completion report to IHEC.

This Ethics Committee is organized and operates according to Good Clinical Practice and Schedule Y requirements.

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Yours truly,

19.9.13

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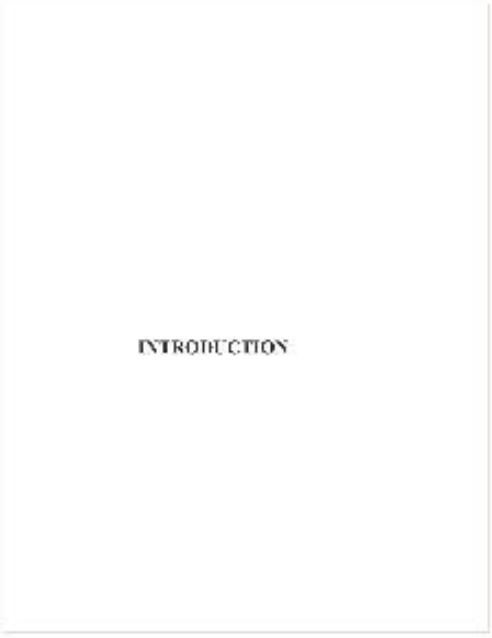
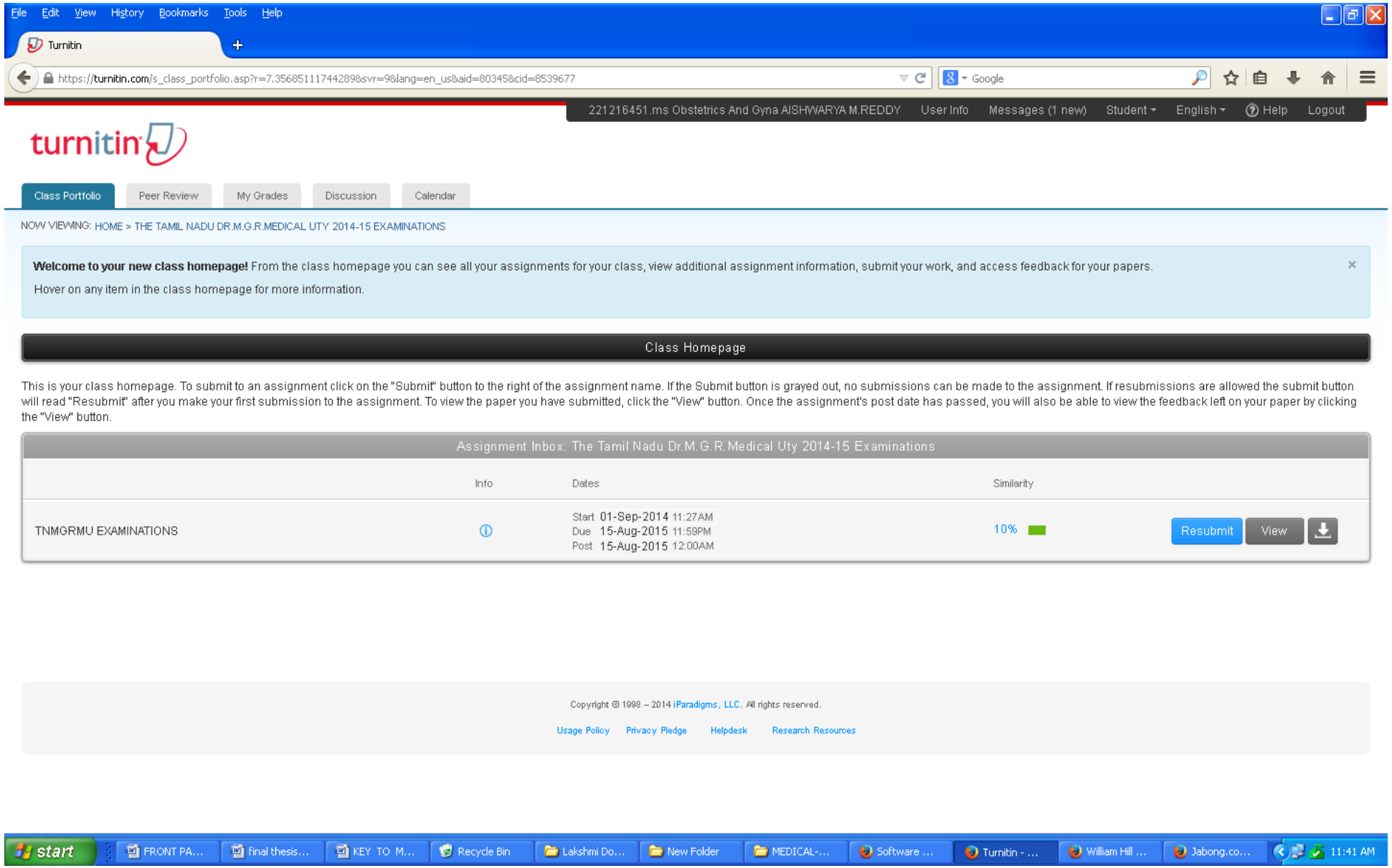

INTRODUCTION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ABBREVIATIONS

AGA - Appropriate for Gestational Age

BMI - Body Mass Index

BMR - Basal Metabolic Rate

FFM - Fat Free Mass

GDM - Gestational Diabetes Mellitus

HDL - High - Density Lipoprotein

IOM - Institute of Medicine

LBW - Low Birth Weight

LDL - Low - Density Lipoprotein

LGA - Large for Gestational Age

PIH – Pregnancy Induced Hypertension

PPH – Post partum Haemorrhage

SD - Standard Deviation

SGA - Small for Gestational Age

VLDL - Very - Low- Density Lipoprotein

WHO - World Health Organisation

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Introduction

INTRODUCTION

Early pregnancy BMI and weight gain during pregnancy are important predictors of adverse pregnancy outcomes. The problems during pregnancy were more related to low BMI previously, but with changing lifestyle, obesity is increasing rapidly especially in urban set ups and may become a major health problem in the future.

Studies have found that Gestational diabetes, Pregnancy Induced Hypertension, emergency caesarean section, postpartum hemorrhage, wound infections, preterm delivery, large for gestational age (LGA), and fetal death in utero were more common in overweight and obese mothers.[1] On the other hand underweight women were at a higher risk of developing Anemia, along with adverse neonatal outcomes like Intrauterine Growth retardation(IUGR) and prematurity.

Maternal nutritional status plays a vital role for the health and quality of life of a pregnant mother and her baby. Utmost importance needs to be given to BMI and the patterns of weight gain during pregnancy, as they are modifiable risk factors of adverse pregnancy outcomes. One should have basic knowledge and awareness regarding the symptoms and signs of adverse pregnancy

outcomes. A better understanding of the complex interrelations between the mother and fetus has led to a vast improvement on antenatal recommendations. The guidelines established by the Institute of Medicine(IOM) regarding weight gain during pregnancy based on pre pregnancy BMI has aimed at obtaining good pregnancy outcomes. [2]

Many studies have been done in the Western countries whereas only few studies have been done on the Asian population. Hence the need of the study is to evaluate the effect of body weight on pregnancy outcome in our Indian population. By performing this study it would be possible to evaluate the association between BMI and its adverse effect on pregnancy outcome. It would also be possible to analyze the association between BMI and gestational weight gain in our Indian set up. The relative risk of various pregnancy outcomes that a patient with extremes of BMI can develop would also be possible to evaluate by doing this study.

Aims And Objectives

AIMS AND OBJECTIVES

1. To study the association between early pregnancy BMI and maternal complications.
2. To determine the association between early pregnancy BMI and labour outcome.
3. To analyze the influence of early pregnancy BMI on neonatal outcome.
4. To evaluate the association between early pregnancy BMI and gestational weight gain.
5. To evaluate the risk of developing adverse maternal and fetal outcomes in women with extremes of BMI.

SAMPLE SIZE : 253

STUDY DESIGN : Prospective observational study

Review of Literature

REVIEW OF LITERATURE

Early pregnancy BMI and gestational weight gain are crucial predictors of adverse pregnancy outcomes. The Institute of Medicine(IOM) has brought out recommendations for weight gain during pregnancy since 1990. [3]

The association between BMI and adverse maternal and fetal outcomes has well been established with a huge body of literature to support it. Gestational weight gain is a potentially modifiable risk factor of pregnancy outcome and hence importance has to be given to it by understanding its effects on the mother and baby. High weight gain is associated with risks of developing Gestational diabetes, PIH, cesarean section, post partum haemorrhage, macrosomia and shoulder dystocia during deliveries,[4,5,6] .Low weight gain has been known to cause maternal anemia, small for gestational age babies and prematurity. [7,8,9] Studies have shown that women with high BMI may benefit from low weight gain during pregnancy [10] , and the same holds good with underweight women.

The prevalence of obesity is on the rise in a rapid way probably due to the changing lifestyles especially in our urban setup, with pregnancy contributing further to it. A recent study done

in UK between 2002-2004 showed that 1 in 5 antenatal women were obese. [11] The understanding of this preventable association plays a pivotal role as it adds to the disease burden in women and their babies, causing anxiety and extra medical costs as well. This understanding will help prevent the possibility of acquiring pregnancy complications by taking cautious measures by our antenatal women.

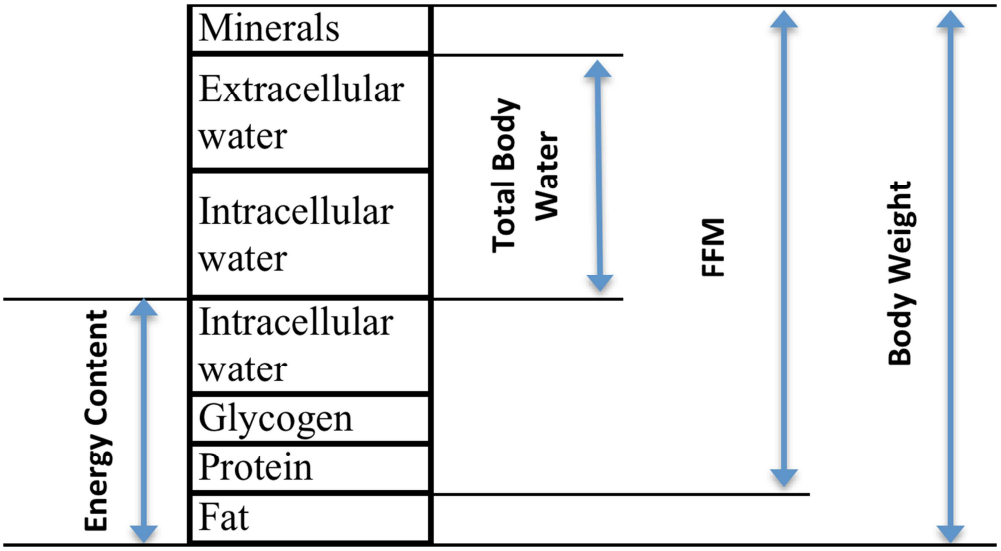
Body composition and Energy stores:[12]

Under nutrition is defined as a deficiency in calorie intake when compared to the energy consumed, whereas over nutrition implies an excess in calorie consumption when compared to the energy spent.

A 70 kg individual has energy stores comprising about 15 kg as fat, 0.4 kg as glycogen and 6 kg as protein. 15-25 % of the energy is stored as fat with women having greater amount of stores than men.

During times of starvation an individual with normal BMI can withhold fasting for a period of 2 months, whereas an obese individual can do the same for periods longer than 12 months depending upon the amount of fat stores and the energy spent.

Figure: 1 Schematic representation of body composition of a Healthy subject



Nutritional Assessment

The components that need to be taken into consideration regarding an individual's nutritional status assessment are Dietary history, clinical examination and anthropometry. [13]

Dietary History

Diet plays an important role in contributing to an individual's BMI. Quality and quantity of diet taken by a patient can be obtained by simply asking the patient to recall her daily food intake over a period of 24 hrs or even maintain a food diary where the total calories along with the intake of the required nutrients can be

calculated and compared with tables of recommended nutrient intake. Questionnaires may also be helpful in educated patients.

Clinical Examination

Measurements such as weight and height are recorded and Body Mass Index(BMI) is calculated respectively using the QUETELET INDEX. The advantage of this index rather than using weight alone is that its height independent.

$$\textbf{BMI = Weight(kg)/ Height}^2\textbf{ (m}^2\textbf{)}$$

Table 1 : Classification of BMI by WHO (Weight / Height ^{2})

Underweight	< 18.5
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	30.0 – 39.9
Morbidly obese	> 40

Anthropometry

The measurements of the size and proportion of the human body is also an important predictor of nutritional status. This is done by calculating the proportion of fat and muscle using the formula as given under

Mid arm muscle circumference = arm circumference– triceps skin fold

Table 2 : Anthropometric Mesurements[13]

Anthropometric measurements			
	Men	**Women**	**Interpretation**
Anthropometric measurements	12.5	16.5	Adequate
	6.0	8.0	Borderline
	2.5	3	Severe depletion
Anthropometric measurements			
Anthropometric measurements	25.5	23.0	Adequate
	20.0	18.5	Borderline
	15.0	14.0	Depletion
	10.0	9.0	Severe depletion

Energy Requirements and intake of calories[13]

The largest component of energy expenditure is attributed to the lean body mass and is known as the Basal Metabolic Rate(BMR). Women have a lower Basal Metabolic Rate and lean body mass when compared to men. The basal metabolic rate is directly affected by factors such as age, sex , physical activity and weight of which physical activity is the most important. The energy required is more for growth, pregnancy, lactation and physical activity.

Table 3 : Daily energy requirements according to Physical activity[12]

Circumstances	Healthy adult females	Healthy adult males
At rest	1600 kcal	2000 kcal
Light work	2000 kcal	2700 kcal
Heavy work	2250 kcal	3500 kcal

Metabolic changes in pregnancy[14]

A series of metabolic changes occur during pregnancy in response to the increased demands of the rapidly growing fetus and placenta. The maternal BMR increases by 10-20 % compared to that of the non pregnant state by the third trimester of pregnancy, which is further increased by an additional 10 % in twin gestations. Metabolic changes during pregnancy result in a small percentage of increased weight gain due to increase in maternal reserves- cellular water, fat and protein.

Fat metabolism[15]

Fat stores start accumulating mainly during mid pregnancy, the available fat being used for placental transfer during the third trimester when fetal growth rate is maximum. During late pregnancy, changes of maternal hyperlipidemia sets in. The concentration of serum lipids, lipoproteins(VLDL, LDL and HDL) and apolipoproteins increase during pregnancy along with essential fatty acid requirements mainly during the third trimester when compared to the non pregnant state. These changes occur due to increased lipolytic and decrease in lipoprotein lipase activities in adipose tissue. Action of progesterone and estradiol on the hepatic system

also play a pivotal role. With the birth of the baby, the concentration of lipids, apolipoproteins and lipoproteins fall aided faster by lactation.

Carbohydrate metabolism[14]

Fasting hypoglycemia, post prandial hyperglycemia and hyperinsulinemia are the physiological changes that occur normally during pregnancy. The probable reason for insulin resistance could be due to the hormones progesterone and estrogen, increased lipolysis with liberation of free fatty acids by the growth hormone like action of increased plasma levels of placental lactogen that increase with gestation.

There is a switch from a state of postprandial hyperglycemia to fasting hypoglycemia that occurs during pregnancy along with an increase in plasma concentrations of fatty acids, cholesterol and triglycerides.

During periods of prolonged fasting in pregnancy, accelerated starvation results from this switch in fuels from glucose to lipids, resulting in ketonemia.

Water metabolism

Pregnancy brings about a physiological change that results in increased water retention which is mediated partly by a fall in plasma osmolality. The minimum amount of extra water retention at term is approximately 6.5 L. [14]

Studies have shown that both the initial maternal weight and maternal weight gained during pregnancy are associated with antenatal complications and birth weight. Studies have also shown that in well nourished women, maternal body water rather than fat is highly significantly correlated with infant birth weight.[15]

Protein metabolism[14]

During pregnancy about 1000 g of extra proteins is deposited with half going to fetus and placenta and the other 500 g is added to the uterus as contractile protein, to the breast glandular tissue, plasma proteins and haemoglobin. [14] The increased concentration of amino acids in pregnancy is largely regulated by the placenta which not only concentrates amino acids into the fetal circulation but also plays a role in protein synthesis, oxidation and transamination of some non essential amino acids. [14] Nitrogen conservation is

associated with pregnancy which has been shown to increase with gestation.

Weight gain during pregnancy

The Institute of Medicine(IOM)(1990) has defined weight gain in 3 ways: [3]

- Total weight gain is defined as weight just prior to delivery minus weight prior to conception.
- Net weight gain is the total weight gain minus the infant's birth weight
- Rate per week is the weight gained over a specific period divided by the duration of that period in weeks.

In our country due to the lack of awareness especially in the rural areas, it is very difficult to be able to get the pre- pregnancy body weight of a woman. Keeping this in mind, usually Gestational weight gain is the total weight gain during pregnancy, taking early pregnancy weight (< 12 wk GA) into consideration.

During the first trimester of pregnancy, the rate of weight gain is the slowest, constant during the second and beginning of third trimester and slows down during the end of the third trimester.

Maternal factors such as age, pre pregnancy BMI , ethnicity and smoking status may alter the rate of weight gain causing variations.[3] Weight gain during pregnancy occurs due to certain physiological events , contributed by tissues and body fluids. Hyten(1991) [16] has proposed his calculations of the components of the total gestational weight gain based on two studies (Humpreys 1954, Thompson &Billewicz 1957) [17,18] This is shown in the table.

The average total gestational weight gain was 12.5 kg at 40 weeks gestation in healthy primiparas without any antenatal complications and whose weight gain was not restricted. The weight gain ranged in a wide way from weight loss to 23 kg or more along with variations noted in different individuals.

Table 4: Analysis of weight gain based on physiological events during pregnancy

Cumulative increase in weight(g) Modified from Hytten(1191) [16]

Tissues & fluids	10 weeks	20 weeks	30 weeks	40 weeks
Fetus	5	300	1500	3400
Placenta	20	170	430	650
Amniotic fluid	30	350	750	800
Uterus	140	320	750	800
Breasts	45	180	360	405
Blood	100	600	1300	1450
Extravascular fluid	0	30	80	1480
Maternal store(fat)	310	2050	3480	3345
Total	650	4000	8500	12500

Factors affecting Gestational Weight Gain

Diet

Previously studies have shown that diet was related to low gestational weight gain, anemia and low birth weight. But lately, due to changing lifestyles, with the incidence of obesity on the rise, studies have shown that there is an association between higher energy intake and higher gestational weight gain.

In 1990, IOM established that energy intake was directly proportional to weight gain stating that energy intake is a determinant of gestational weight gain. A study done in US on 224 women showed that energy intake during the second trimester was positively related to gestational weight gain. [19] Another study in Iceland observed in 406 antenatal women showed that a higher energy intake in the third trimester of pregnancy caused a higher gestational weight gain among overweight women only.

Studies have shown that intake of energy and fat is positively associated with gestational weight gain while carbohydrates and fiber have a negative association, which was observed in overweight women only. [20]

A study on 622 US women showed that an increase in the quantity and quality of food such as milk and sweets showed an association with excessive gestational weight gain.

Hence the importance of data collection on dietary intake is very important, easy and beneficial. Various methods such as weighed 7- day food records at each pregnancy trimester (Bergmann et al.)(1997)[21] , the validated semi quantitative food frequency questionnaires (Lagiou et al 2004) , 24 hr dietary recall twice during pregnancy [22] have been used. But one has to remember that calorie intake solely cannot be associated to gestational weight gain and other factors such as physical activity, age and ethnicity should be taken into consideration. [19]

Physical activity

Studies have shown that the amount of physical activity is inversely proportional to the amount of gestational weight gain.[23] Higher pre pregnancy physical activity levels were associated with reduced weight gain during the third trimester of pregnancy but not during mid pregnancy.

OTHER FACTORS

Factors such as pre pregnancy BMI, parity, maternal age, ethnicity, smoking, education status, caffeine and stress are associated with weight gain during pregnancy.

Pre pregnancy BMI

The most important factor seems to be that of pre pregnant BMI which is associated with excessive weight gain in pregnancy. It was seen that obese and overweight women gained excess weight which was more than what the Institute of Medicine(IOM) had recommended. [23,24] The average gestational weight gain among obese and overweight women is lower than women with normal BMI because the weight gain recommendations for obese women are lower and vice versa. It is said that hormones such as leptin, insulin and ghrelin which are in higher proportion in obese women could be the reason for higher gestational weight gain in such individuals.[22,25]

Parity

One other factor linked to gestational weight gain is parity . Nulliparous women have more weight gain during pregnancy

exceeding the recommended gain by IOM, compared to mutipara.[17,18,26]

Education status

When it came to education status, studies have shown that educated women had a weight gain within the recommended range compared to uneducated women, probably due to awareness and knowledge regarding the adverse pregnancy outcomes associated with extremes of BMI.[24]

Psychological factors

There are either not enough studies or the studies done have shown conflicting results regarding the association between weight gain and psychological factors such as stress, depression and social support. [23,27.28]

Ethnicity

From the few studies done regarding the association between ethnicity and gestational weight gain, [3] it has been shown that African- American women have an increased incidence of low prenatal weight gain but a decreased tendency to gain more weight than recommended when compared with Caucasians.

Weight gain in pregnant adolescents

Pregnant adolescents face problems of anemia and low birth weight babies because all the energy consumed by them goes partly for their own growth besides the growth of the fetus and placenta. But recent studies have shown that pregnant adolescents gain more weight than adults and produce healthy babies of good weight. Compared to adult standards, adolescents may be considered underweight with limited fat stores, when actually they might not be underweight or undernourished for their age and maturity. [29] Many ongoing studies are being done as to whether this may be true, but until then as much as we should allow teenage mothers to consume a good amount of calories, we should also be concerned whether their weight gain may be contributing to obesity.

Weight gain in Multiple pregnancy

Weight gain should be encouraged throughout the pregnancy period in cases of multiple pregnancy for the sake of the growing fetuses as well as the mother. A maternal weight gain of 40-45 pounds is associated with outcome of twins weighing around 2.5 kg . A Study done by Lantz showed that weight gain should be according to the pre pregnant BMI. In women with low BMI a

weight gain of 1.75 pounds/week after 20 weeks gestation is recommended, whereas in women with normal BMI, it was 1.5 pounds / week during the second half of pregnancy. [30]

Recommendations for weight gain in Pregnancy

It is a known fact that weight gain is associated with maternal and fetal outcome. The IOM has published recommendations regarding weight gain in pregnancy for healthy women with singleton pregnancy in USA.[3] High weight gain is associated with DM, HTN, prolonged labour, cesarean section and big babies of the many complications. Whereas low weight gain is associated with IUGR, low birth weight babies and increased neonatal morbidity.

The recommendations made by IOM were based on pre pregnancy BMI, because BMI is known to have adverse effects on pregnancy outcome. Underweight women usually give birth to low birth weight babies and hence are recommended to gain more weight than women with normal BMI. Likewise obese women are recommended to gain less weight which does not effect fetal growth since the effect of weight gain on birth weight is weak in such patients. Excessive weight gain adds to the maternal stores and also

causes generalized edema. [3]

IOM has recommended a weight gain of 1.0 to 3.5 kg during the first trimester. For underweight women, an average weight gain of 0.5 kg per week is recommended during the second and third trimester , 0.4 kg for normal weight women and 0.3 kg for overweight women. The recommended weight gain for a teenage mother would be the upper end of the recommended weight gain as she needs energy for her own growth along with the fetus and placenta. Around 16- 20 kg weight gain is recommended for twin pregnancies. Studies have shown that women following the IOM recommendations have had the best pregnancy outcome. [4,15,31,32] but there are a lot of variations such as physical activity and BMR that need to be taken into consideration.

Table 5 : IOM recommended total weight gain ranges by pre pregnant BMI [33,34]

Recommended total gain		
Category(BMI in kg/m^2)	**kilograms**	**Pounds**
Underweight (<18.5)	12.5 to 18	28 to 40
Normal (18.5 – 24.9)	11.5 to 16	25 to 35
Overweight (25.0 – 24.9)	7 to 11.5	15 to 25
Obese (> 30)	5 to 9.1	11 to 20

Energy requirement and recommended dietary allowances

Energy in the form of diet and nutrition is required by all individuals especially during pregnancy for the maintenance of the mother and her growing fetus. During pregnancy the right amount of nutrition and energy intake is needed in order to prevent many adverse maternal and neonatal effects due to increased or reduced weight gain. In order to do so every antenatal mother should have a calorie intake chart containing the amount of calories contained in each food item and also a chart containing the daily recommended dietary allowances of all the crucial vitamins and minerals.

The required amount of calorie intake differs from person to person and depends on factors such as pregnancy, lactation, physical activity, age, ethnicity and so on.

During pregnancy, an additional 80000 kcal is required for the mother and her fetus. Maximum intake is needed during the third trimester (400 – 500 kcal/day) when compared to the first (negligible) and second trimester (250 – 350 kcal/day). Approximately a calorie intake of 100 to 300 kcal is needed on a daily basis during pregnancy after excluding factors such as the amount of age , ethnicity and geographical location.

The recommended dietary allowances for pregnant and lactating women were published by the food and nutrition board of the Institute of Medicine in 2008 .[14]

TABLE 6 :

Recommended Daily Dietary Allowances for Adolescent and Adult Pregnant and Lactating Women [14]				
	Pregnant		**Lactating**	
Age (years)	14-18	19-50	14-18	19-50
Fat-soluble vitamins				
Vitamin A	750µg	770µg	1200µg	1300µg
Vitamin Da	5µg	5µg	5µg	5µg
Vitamin E	15mg	15mg	15mg	19mg
Vitamin Ka	75µg	90µg	75µg	90µg
Water-soluble vitamins				
Vitamin C	80mg	85mg	115mg	120mg
Thiamin	1.4mg	1.4mg	1.4mg	1.4mg
Riboflavin	14mg	14mg	16mg	16mg
Niacin	18mg	18mg	17mg	17mg
Vitamin B6	1.9mg	1.9mg	2mg	2mg
Folate	600µg	600µg	500µg	500µg
Vitamin B12	2.6µg	2.6µg	2.8µg	2.8µg
Minerals				
Calciuma	1300mg	1300mg	1300mg	1000mg
Sodiuma	1.5g	1.5mg	1.5mg	1.5mg
Potassiuma	4.7g	5.1mg	5.1mg	5.1mg
Iron	27g	10mg	10mg	9mg
Zinc	12mg	13mg	13mg	12mg
Iodine	220µg	290µg	290µg	290µg
Selenium	60µg	70µg	70µg	70µg
Others				
Protein	71g	71g	71g	71g
Carbohydrate	175g	175g	210g	210g
Fiber*	28g	28g	29g	29g
*Recommendations measured as Adequate Intake (AI). From the food and nutrition board of the Institute of Medicine (2008).				

Epidemiology of gestational weight gain

Studies have shown the significance of adequate gestational weight gain, the deficiency or excess of which is associated with adverse pregnancy outcomes. IOM has published recommendations regarding weight gain in pregnancy according to the respective BMI category. [58,59] Earlier it was a belief that if a pregnant woman had consumed excessive calories and gain more weight than needed, she would deliver a healthy baby. But soon due to awareness and knowledge, it was found that excessive and unnecessary calorie intake would only add to unwanted maternal fat and lead to obesity, unless needed.

In the early 1900s, studies showed that weight gain of 10 kg was gained in singleton uncomplicated pregnancies on an average in the USA. [3] Reports of studies done in Britain in 1950s showed an average weight gain as 12.5 kg.[16] Later it was observed that the average weight gain in the 1980s was 16 kg and 13.5 to 16.5 in the 1990s. Some studies showed that the results for weight gain during pregnancy in a series of women across, did not show consistent results. This was probably due to the fact that there might have been differences in study group [8] or probably the pre pregnant weight given by these women may not have been true.

Based on the recommendations by IOM, it was found from studies done after 1980s in USA , that adequate weight gain was seen in 28 to 40 % of the women, 34 to 53 % of women had excessive weight gain and weight gain was inadequate in 14 to 26 % of women taking pre pregnant BMI into account [15, 28] or sometimes BMI from the first antenatal visit during early pregnancy.

Obesity and its effect on pregnancy outcome

In India, previously the problems during pregnancy were more related to low BMI but with changing lifestyle, the incidence and prevalence of obesity is increasing rapidly especially in urban set ups and may become a major health problem in the future , with pregnancy contributing further to it. A recent study done in UK between 2002-2004 showed that 1 in 5 antenatal women were obese. [11]

Studies have found that Gestational diabetes, Pregnancy Induced Hypertension, wound infections, preterm delivery, large for gestational age (LGA), shoulder dystocia, emergency caesarean section, postpartum hemorrhage and fetal death in utero were more common in overweight and obese mothers.

Hence it is important for every obstetrician to be well trained in anticipating and encountering difficulties during the antepartum, intrapartum and postnatal periods and prompt action needs to be taken in knowing how to manage such problems.

Definition

WHO defined overweight as a BMI of more than 25 kg/m^2 and obesity as a BMI of more than 30 kg/m^2(waist : hip ratio > 0.85). In 2002, Freedman and colleagues classified obesity further into Class 1 (BMI – 30 to 34.9 kg/m^2), Class 2 (BMI – 35 to 39.9 kg/m^2) and Class 3 (BMI - >40 kg/m^2) .[14]

Reproductive problems associated with Obesity

The effect of high BMI on infertility and miscarriage is well known. Various studies have shown that the link between Obesity and infertility could be associated with factors such as hyperandrogenism, polycystic ovaries(PCOS) and anovulatory cycles.

The increased use of assisted reproductive techniques such as intra cytoplasmic sperm injection and in vitro fertilization associated with infertility has caused a higher rate of miscarriages in these women. It has been shown that the live birth rate was 30 % lower

in women undergoing IVF with BMI more than 27 compared to women with normal BMI. [35]

Antenatal complications associated with Obesity [11]

- Overt and gestational diabetes
- Pregnancy induced Hypertension
- Respiratory complications such as asthma and sleep apnoea
- Thromboembolic disease
- Infections of urinary tract ,wound infections and endometritis

Gestational Diabetes Mellitus

Obesity is a risk factor for carbohydrate intolerance in both pregnant as well as non pregnant women. Out of the 17 % of obese women, approximately 1 – 3 % develop Gestational diabetes. Studies have shown that the association between diabetes, hypertension and obesity may be a manifestation of the X syndrome . Screening for gestational diabetes needs to be performed twice in obese patients, at 24 weeks and again at 32 – 34 weeks even with the first result being normal , as women with a risk of developing diabetes has also an increased risk of developing hypertension, macrosomia in the infant and finally predisposing the woman at a risk of developing

type 2 diabetes in later life. Studies have also shown that obese women have two times the risk of delivering babies with congenital malformations than those without. Diabetic women were also seen to have increased weight retention in the postpartum period.[36]

Pregnancy induced Hypertension

Pre pregnancy BMI is positively associated with Pregnancy induced hypertensive disorders such as pre-eclampsia. It was seen that an increased pre pregnancy BMI of 5 – 7 kg/m^2 showed a doubling of the risk of pre- eclampsia. In general, the incidence of pre-eclampsia in obese women is 14 - 25 %. Such women with a history of pre-eclampsia in the previous pregnancy have a higher risk of recurrence of the disease in the next pregnancy.

Recent studies have shown that a low level of sex hormone – binding globulin, a marker of insulin resistance in obese women, is an early predictor of pre-eclampsia thus allowing preventive treatment. The need for preventive measures, is that antenatal women not only develop adverse maternal and fetal outcomes but also in the long run, these women may die from cardiovascular disease and stroke.

Respiratory complications

Increased BMI has been shown to be associated with sleep apnoea and asthma. It was shown that obese women had a 4 % oxygen desaturation when compared to non obese women. The probable cause could be the deposition of excess fatty tissue around the neck causing obstruction and difficulty in breathing during sleep leading to apnoea. A neck circumference of 40.5 cm in women and 43 cm in women has shown to be associated with difficulty in breathing, recurring upto 30 times a night.

Problems associated with sleep apnoea are stroke, arrhythmias, pulmonary hypertension, right heart failure and even death due to day time somnolence- while driving.

Thrombo – embolic complications

Thrombo- embolism is another risk factor associated with obesity. Obesity is associated with a 12 fold increase in thrombo-embolism. Many deaths have occurred due to thrombo- embolism in pregnancy. Studies have shown that the ratio of deaths from thrombo- embolism in pregnant women is 1 in 70,000, when compared to 1 in a million in a non pregnant state. The effective prophylaxis in pregnancy is Low molecular weight heparin which

can be given to all antenatal women during the early pregnancy period, who are at high risk of developing thrombo- embolism, obesity being one of them.[37]

Infections

Delayed wound healing was noticed in many obese women, more commonly associated with Gestational diabetes. There was also an increased risk of urinary tract infections seen in obese women. But it was seen that there was no increase in the incidence of genital infections in obese women as previously reported.

Metabolic syndrome

Metabolic syndrome is also known as syndrome X or the insulin resistance syndrome , characterized by a tendency to develop central obesity and insulin resistance. It is a syndrome of medical disorders, which when present predisposes individuals to diabetes and cardiovascular disease. It was found that children who were exposed to maternal obesity were at increased risks of developing metabolic syndrome, causing problems in subsequent generations also.

Criteria for the diagnosis of Metabolic syndrome[12]

Patients with three or more of the following :

- Abdominal obesity :waste circumference > 88 cm(34.7 inches) in women or > 102 cm (40.2 inches) in men
- Hypertriglyceridemia- levels of 1.7 mmol/L (or treatment of this abnormality)
- High density lipoprotein: < 50 mg/dl in women or < 40 mg/dl in men.
- Hypertension>135/85 mmHg (or treatment of previously diagnosed hypertension)
- Raised fasting glucose > 5.6 mmol/L (or treatment for previously diagnosed diabetes)

(From the National Institute of Health)(2001)

Adverse labour outcomes associated with Obesity[11]

- Shoulder dystocia
- Induction of labour
- Operative intervention rates (emergency LSCS and vaginal tears)

Shoulder dystocia

Shoulder dystocia has been found to be associated with obesity, probably due to the link between diabetes and obesity. Babies of overweight and obese women are 60 – 100 g heavier than normal weight women , thus increasing the chances of shoulder dystocia .[38]

Induction of Labour

The incidence of labour induction is 1.7 – 2.2 folds more in obese women compared to women with normal weight. There is increased incidence of postdated pregnancies, prolonged labour and failure to progress in obese women and lower chances of spontaneous onset of labour at term. [39] The need for early induction is because of factors such as hypertension, pre- eclampsia and diabetes associated with obesity.

Operative interventions

Operative intervention rates such as emergency LSCS and vaginal tear repairs associated with shoulder dystocia and macrosomia are much higher in obese women than women with normal BMI. The incidence for LSCS for obese women was over 20 % compared to 10 % for normal weight women.

Studies have shown that the need for instrumental deliveries by forceps has also doubled in obese women. It has been seen that Primary caesarean section is most commonly done for cephalo pelvic disproportion.

The risks associated with anaesthesia related complications was also higher in obese women and the difficulties in intubation were also more stressful. Increased peri- operative thrombo- embolic events, post operative infection and increased mortality was seen in obese women.

Incidence of vaginal tears was much higher in obese women, probably due to the use of instrumentation in delivering big and macrosomic babies.

Postnatal complications associated with Obesity

- Postpartum haemorrhage
- Postpartum wound infections
- Longer hospital stay
- Maternal mortality
- Lactation problems

Postpartum haemorrhage

Obese women are more prone to postpartum haemorrhage probably due to trauma associated with difficult deliveries and inability of the uterus to contract adequately in the postpartum period.[40]

Wound infections

Delayed wound healing is a common postpartum complication associated with obesity, due to the increase in abdominal wall fat thickness preventing healing by primary intention, which is further delayed in the presence of Diabetes. This increases the hospital stay. In such cases, an abdominal drain can be kept in situ which will drain out any collected fluid and promote faster wound healing.

Maternal mortality

Postoperative chest complications may lead to venous stasis and thrombosis. In such patients, prophylactic administration of low molecular weight heparins could be helpful and life saving until ambulation.

Lactation problems

There is failure of initiation of lactation and also decreased duration of lactation in obese women.

Adverse fetal outcomes associated with obesity[11, 14]

- Congenital malformations (neural tube defects, cleft palate)
- Macrosomia
- Miscarriage and intrauterine death.
- Intrauterine growth restriction (IUGR)
- Increased NICU admissions
- Fetal distress and low Apgar score

Congenital malformations

Obese women are at an increased risk for neural tube defects, the risk being around 7%. Studies have shown that obese women have a two - three fold increased incidence in heart defects, omphalocele and other anomalies.

Macrosomia

Fetal growth is strongly associated with increased maternal pre -pregnancy weight and decreased pre-pregnancy insulin sensitivity. Macrosomia is defined as birth weight > 4,000 gms. Studies have

shown that with every 5 kg increase in weight during pregnancy, there was a 30 % increase in the risk of macrosomia. The incidence of macrosomias

- 8.3% in normal weight
- 13.3% in obese
- 14.6% in morbidly obese

In early pregnancy, increased maternal insulin resistance alters placenta function and also increases feto placental availability of glucose, free fatty acids and amino acids.

Miscarriage and Intra uterine death

Studies have shown that, obese parous women had a significantly increased risk of late fetal death relative to women with normal BMI . There was a 3 fold increased risk of antepartum still birth in morbidly obese women.

- 1.6 folds increase when BMI was 25 to 29.9 kg/m2
- 2.6 fold increase when BMI was >30 kg/m2
- 3 fold late still birth rate when BMI >40 kg/m2

Rapid fetal growth due to fetal hyperglycemia increases the risk of still birth. In such situations, placenta cannot transfer sufficient oxygen for metabolic requirements, causing hypoxia and death.

Small for gestational age and IUGR

With increasing BMI, the risk of delivery a SGA baby decreases. The same is associated with increasing BMI and IUGR. But studies have shown that prematurity and low birth weight is associated with obesity.

Relation between NICU admissions, Low Apgar and Obesity

Obese women are at a higher risk of having difficult deliveries using instrumentation. This could be because of the large size of the fetuses that can be delivered only with instrumentation. The traumatic delivery associated with it and the increased risk of fetal distress with low Apgar Scores in such women has also lead to higher rates of NICU admissions.

Morbidity in children born to obese women

- Childhood obesity
- Reduced breast feeding and increased over feeding
- Increased exposure to a high calorie diet after weaning
- Increased risk of cardio- metabolic complications in adult life

Childhood obesity[11]

Childhood obesity is linked with maternal obesity. Obese female babies have increased rates of developing GDM. Evidence has shown that elevated antepartum plasma levels of maternal free fatty acids correlate inversely with the intelligence of off spring at 2 – 5 years of age. There is role for in -utero therapy to prevent effects of maternal obesity on subsequent generations.

Research on fetal programming for adult obesity is going on. Children born to obese women were at a high risk of developing metabolic syndrome.

Management[41]

Preconception counseling

Women planning pregnancy should be counseled regarding ideal weight and importance of losing weight before entering pregnancy along with education regarding the risks and complications associated with maternal obesity. Education on nutrition, dieting and exercise, behavior modification, should be given importance.

In obese women in whom these strategies have been unsuccessful, bariatric surgery should be considered. It is the only treatment which

delivers a long term, sustainable weight loss. Studies have shown that bariatric surgery has been associated with increased rates of conception in previously infertile women. Routine screening such as cardiology evaluation and diabetic screening should be done in morbidly obese women before conception.

In pregnancy

Women should be counseled to limit weight gain according to their BMI. IOM has proposed recommendations regarding adequate weight gain in pregnancy according to the respective BMI. Obese women should ideally not lose weight during pregnancy due to increased risk of ketosis.

Early signs of diabetes or hypertension should be carefully watched for. Standard screening tests for fetal anomalies is to be done. Accurate assessment of fetal growth using serial sonography is to be done.[14]

Post partum

Obese women require longer period of hospitalization. Graduated compression stocking, hydration and early mobilization is recommended. Low molecular weight heparin can be given prophylactically in post operative patients until they start mobilizing. Breast feeding should

be encouraged. Obese women have a tendency for increased post partum weight retention. Exercise and diet control is crucial at this stage. [11]

Contraception

Combined OC pills are contraindicated in morbid obesity. There is also increased risk of venous and arterial thrombo-embolism and increased failure rate in obese women. Intrauterine devices have shown to be effective[11]

Effect of maternal weight gain on Neonatal outcome

Evidence shows that increased weight gain was associated with larger fetal size and lower weight gain with smaller size. Studies suggest an inverse relationship between birth weight and the risk of long term adverse health outcomes such as hypertension, obesity, glucose intolerance and cardiovascular disease.[42]In India, the average weight of a normal infant born at term gestation is around 2.8 kg which is less than that of developed countries.[43]

The intra uterine growth charts are used to calculate the expected weight of newborn infants born at a given gestational age . Babies with birth weight ranging between 10th and 90th percentile on such a chart are considered appropriate for gestational age(AGA). Babies

with a birth weight less than10th percentile are categorized as small for gestational age (SGA) infants. Babies with birth weight more than 90th percentile are termed as large for gestational age (LGA).

WHO states that babies weighing more than 4000 gm at birth are classified as big babies and less than 2500 gm at birth are classified as low birth weight (LBW) irrespective of the period of gestation. Big babies are associated with shoulder dystocia. traumatic deliveries and distress. Nearly one third of infants born in India are LBW. Low birth weight is the single most important determinant of neonatal deaths. Over 75 – 90% neonatal deaths occur among low birth weight infants.

Underweight and Pregnancy[41]

According to WHO, Underweight is defined as BMI<18.5 kg /m^2. Nutritional deprivation may arise as a result of starvation, dieting, or chronic eating. Evidence has shown that two leading disorders for women to be underweight in affluent societies were Anorexia nervosa and Bulimia, which has become a major public health concern.

Anorexia nervosa is a syndrome characterized by severe weight loss, a distorted body image and an intense fear of becoming obese.

Anorexia nervosa is not synonymous with bulimia although bulimic symptoms may occur in women with anorexia nervosa.

Bulimia is characterized by recurrent episodes of secretive binge eating followed by self - induced vomiting, fasting or the use of laxatives or diuretics. Depression, alcohol and drug abuse are also prominent features of this disorder. Patients show frequent weight fluctuations but are more likely to have significant weight loss as seen in women with anorexia nervosa.

Risks

Nutritional deprivation has a negative effect on birth weight. Underweight women are likely to deliver infants who are small for gestational age when compared to women of normal weight. Fetal complications associated with underweight women are Low birth weight babies, birth asphyxia, neonatal hypoglycemia and hypothermia. Under weight women are at increased risk of developing anemia due to deficiency of required calorie intake.. Perinatal mortality rate has found to increase in such women.[41]

Pregnancy outcome in anorexic and bulimic women varies. If the eating disorder is in remission then an uneventful pregnancy and a favorable pregnancy outcome can be anticipated. However, active

anorexia nervosa or bulimia at the time of conception may have a number of severe health problems including electrolyte imbalances, dehydration, depression, social problems and poor fetal growth. Appropriate psychiatric treatment is warranted.

Management options[14]

Pre pregnancy

Women with anorexia or bulimia who wish to conceive are advised to wait until the remission period. Women who wish to conceive with problems of anovulatory infertility, should be advised to gain weight rather than being started on ovulation drugs.

Pre Natal

In view of the increased risk of low birth weight, early detection of IUGR should be made. Careful dating of gestation is important. Patient is asked to gain weight adequately and weight monitoring has to be done including daily calorie intake chart. Anemia may be corrected with oral or parental preparations.

Labor and Delivery

If fetal growth restriction is suspected, the patient should be admitted to a higher center where continuous electronic fetal heart rate monitoring is advised, in order for timely detection of fetal distress. Emergency neonatal services should be readily available for resuscitation. Anemia, if present may be corrected with blood products and iv fluids may be given as needed.

Post Natal

Post partum depression is associated with 40% of women with eating disorders. Treatment with antidepressant drugs may be required. Anemia may be corrected with oral or parental preparations and an iron calorie rich diet is advised to be taken.

Materials and Methods

MATERIALS AND METHODS

A Prospective observational study comprising 253 antenatal women with singleton uncomplicated pregnancies, booked at PSG Hospital within the first 12 weeks of gestation between September 20013 – August 2014 was carried out. The criteria taken into consideration for the study were as follows :

INCLUSION CRITERIA:

- Antenatal patients only
- Booking in the first trimester of pregnancy
- Singleton pregnancy

EXCLUSION CRITERIA:

- Patients with pre –existing medical disorders like Chronic hypertension, overt diabetes, over hypothyroidism and connective tissue disorders such as SLE.
- Multiple pregnancy
- No antenatal visits in the first trimester of pregnancy

The study was carried out in the following way :

Women with singleton uncomplicated pregnancies, booked at PSG Hospital within the first 12 weeks of gestation were included in my study. Informed consent was taken. With the help of a pre-designed questionnaire, basic information including weight and height was collected in the first checkup and BMI calculated accordingly.

Patients were divided into 4 groups such as

Underweight (<18.5 kg/m^2)

Normal (18.5-24.9)

Overweight (25-29.9)

Obese (30 and above)

BMI was calculated using the formula weight(kg) / $height^2(m^2)$ (QUETELET'S Index). Weight gain during each visit was recorded and development of any antenatal complications throughout pregnancy was noted down. Information regarding postnatal complications, gestational age at delivery and also birth weight and Apgar score of the neonate was collected from the case sheets following delivery.

During the study, patients who lost follow up were removed and new patients were included to maintain the sample size of 253.

Results

RESULTS

STUDY DESIGN

A Prospective observational study comprising 253 antenatal women with singleton uncomplicated pregnancies, booked at PSG Hospital within the first 12 weeks of pregnancy was conducted during the period September 2013- August 2014, to study the association between early pregnancy and weight gain during pregnancy in relation to adverse pregnancy outcomes.

A pre-designed questionnaire and data collection analysis was performed. Variables like age, parity, gestational age, BMI distribution based on four classes of BMI, maternal and fetal complications, association between weight gain of the population according to BMI, fetal complications ,association between BMI and pregnancy outcomes, association between birth weight with BMI were studied.

STATISTICAL METHOD AND SOFTWARE

Descriptive analysis has been done using SPSS 15.0 software and graphs, tables and charts obtained by Microsoft excel and word. Results on continuous measurements are presented on Mean ± SD(Min-Max)and categorical measurement in Number (%). Chi-square test was used to find the association between early pregnancy BMI,

weight gain, maternal and fetal outcomes. Relative risk has been calculated and the risk of overweight, obese and underweight women having adverse pregnancy outcomes has been compared to normal BMI groups.

Table 7: Age distribution of the study population

	Total number(n)	Minimum	Maximum	Mean	Std. Deviation
Age in years	253	18.00	40.00	25.5020	4.00260

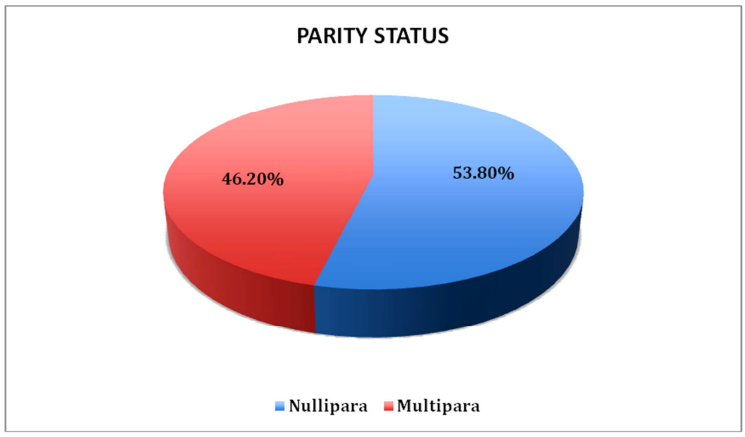
The age of the subjects were in the range of 18 – 40 years.

The mean age of the subjects in my study was 25 years.

Table 8 : Distribution of study participants based on Parity status

Parity status	Number of subjects	Percentage
Nullipara	136	53.8
Multipara	117	46.2
Total	253	100

FIGURE 2: Distribution of subjects based on Parity status

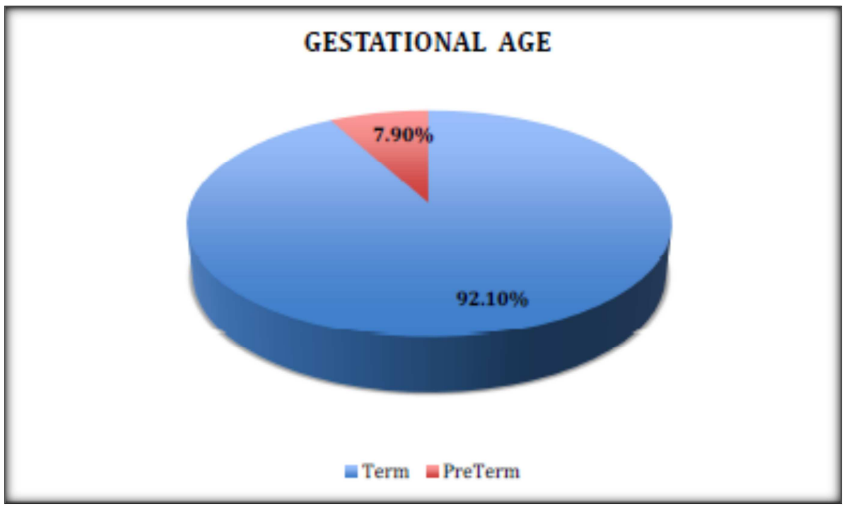


Frequency and percentage distribution is shown in the above table. In my study , 53.8% of the study population were nullipara and 46.2% of study population were multipara .

Table 9 : Distribution of study participants based on Gestational Age

Gestational Age	Number of subjects	Percent
Term	233	92.1
Preterm	20	7.9
Total	253	100

FIGURE 3: Distribution of study participants

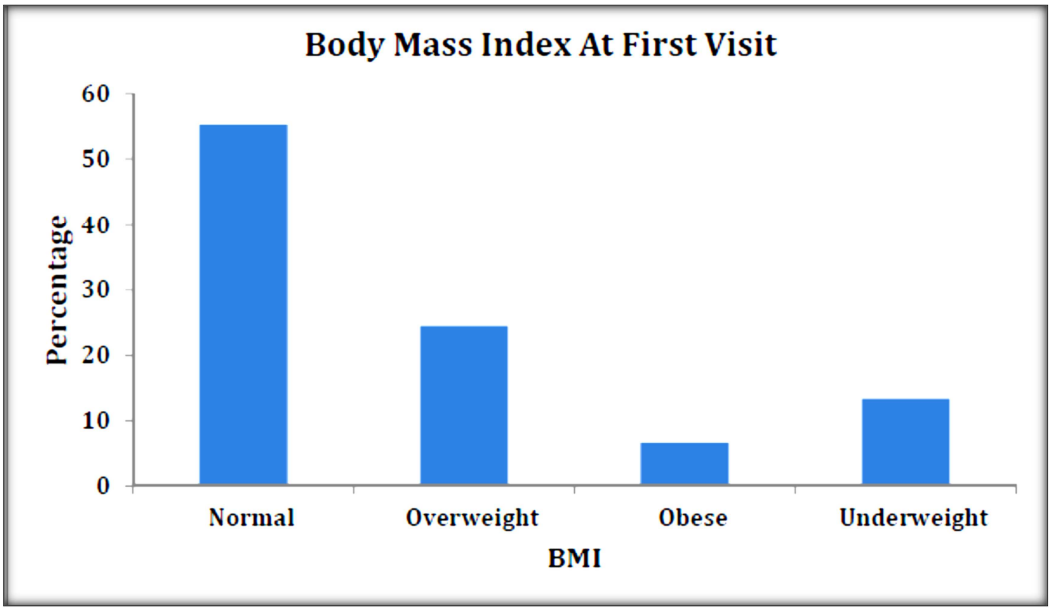


Frequency and percentage distribution is shown in the above table. 92.1 % of the subjects were term patients with gestational age 37-40 weeks and7.9 % of the subjects were preterm patients with gestational age less than 37 weeks.

Table 10 : Frequency and distribution of BMI At First Visit

BMI	Number of subjects	Percent
Normal	140	55.3
Overweight	62	24.5
Obese	17	6.7
Underweight	34	13.4
Total	253	100.0

Figure 4 : Distribution of BMI at first visit

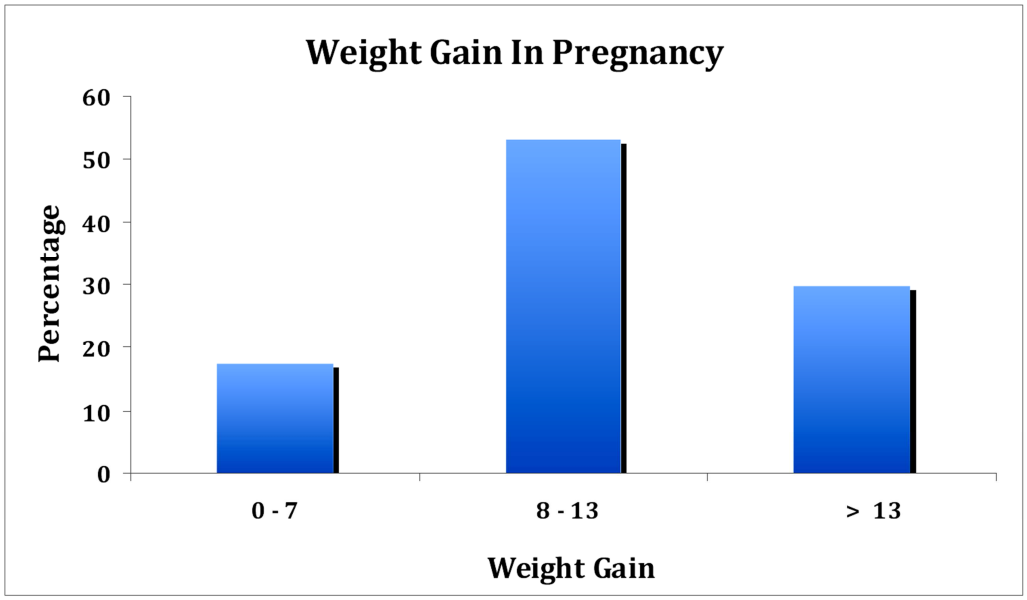


Frequency and percentage distribution is shown in the above table. 55.3 % of the subjects fell in the normal BMI group.24.5 % of the subjects fell in the overweight group.6.7 % of the subjects fell in the obese group. 13.4 % of the women fell in the underweight group.

Table 11 : Distribution of subjects based on Weight Gain In Pregnancy

Weight Gain	Number of Subjects	Percentage
0 – 7	44	17.4
8 – 13	134	53.0
> 13	75	29.6
Total	253	100

FIGURE 5 :Frequency distribution of subjects based on weight gain

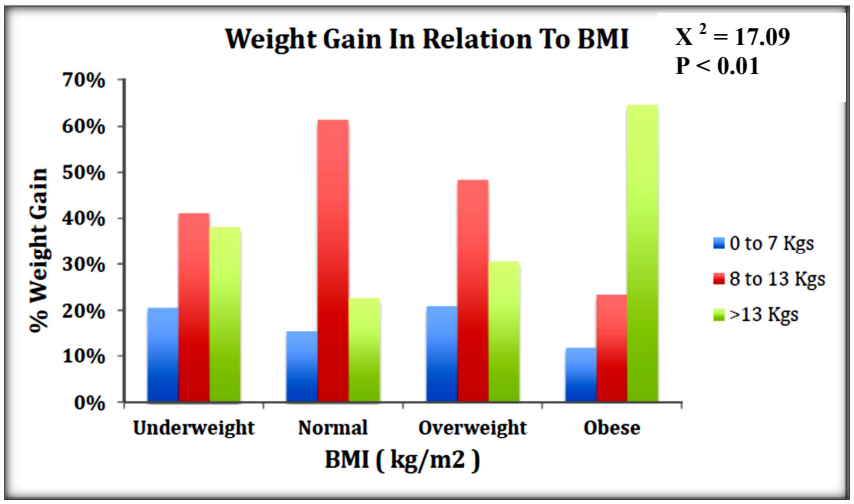


17.4 % of the subjects showed a weight gain of 0 – 7 kg. 53 % of the subjects showed a weight gain of 8 – 13 kg during pregnancy. 29.6 % of the women showed a weight gain of more than 13 kg.

Table 12 :Weight gain in Association To BMI

BMI		Weight Gain(kg)			Total
		0 - 7	8 - 13	> 13	
Normal	Number	22	86	32	140
	%	15.7 %	61.4 %	22.9 %	100 %
Overweight	Number	13	30	19	62
	%	21 %	48.4 %	30.6%	100 %
Obese	Number	2	4	115	17
	%	11.8 %	23.5 %	64.7 %	100 %
Underweight	Number	7	14	13	34
	%	20.6 %	41.2 %	38.2 %	100 %
Total	Number	44	134	75	253
	%	17.4 %	53 %	29.6%	100 %

FIGURE 6 : Weight gain in association to BMI

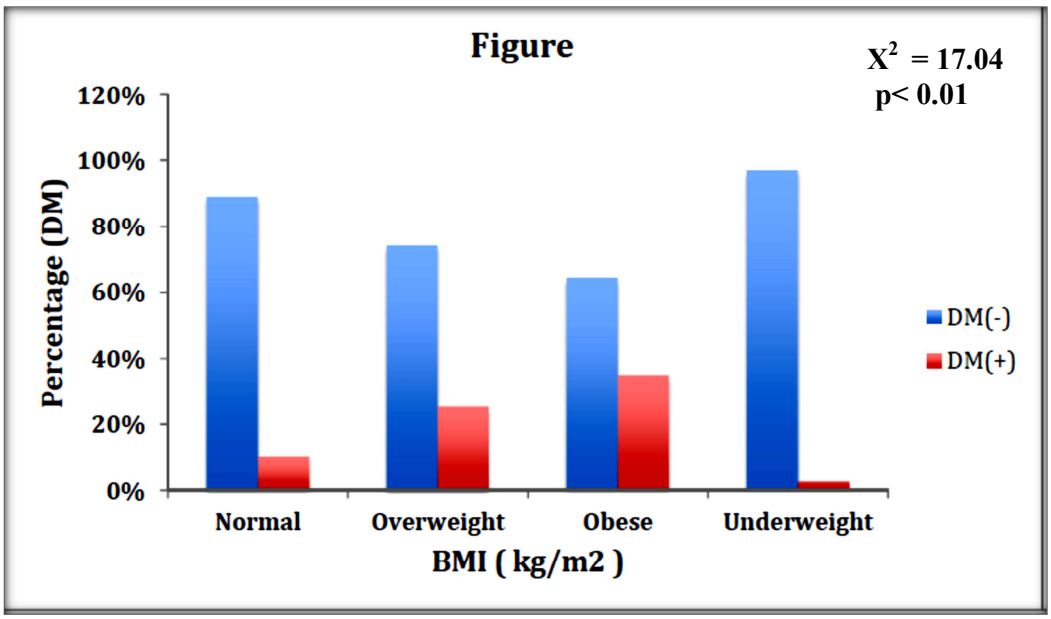


Weight gain in relation to BMI was analyzed. In my study maximum weight gain was noticed in the obese group(64.7%) individuals, whereas minimum weight gain was seen in underweight women (17.3%) and women with normal BMI. Association between weight gain and BMI was performed using Chi-Square analysis. Overall weight gain is significantly associated with BMI ($X^2 = 17.09$, $P < 0.01$)

Table 13 : Association between BMI and Diabetes Mellitus(DM)

BMI		Diabetes Mellitus(DM)		Total
		DM (-)	DM (+)	
Normal	Number	125	15	140
	%	89.3 %	10.7 %	100 %
Overweight	Number	46	16	62
	%	74.2 %	25.8 %	100 %
Obese	Number	11	6	17
	%	64.7 %	35.3 %	100 %
Underweight	Number	33	1	34
	%	97.1 %	2.9 %	100 %
Total	Number	215	38	253
	%	85.0 %	15.0 %	100.0 %

FIGURE 7: Association between BMI and Diabetes Mellitus(DM)



Diabetes Mellitus in relation to BMI was analyzed. In my study maximum number of patients in the obese group(35.3%) developed DM and minimum number of patients in the underweight

group(1%) developed DM. Association between Diabetes Mellitus and BMI was performed using Chi-Square analysis and the results obtained in the above table. It has been shown that Diabetes Mellitus is significantly associated with BMI ($X^2 = 17.04$, $p < 0.01$).

Relative Risk

Table 13.1

Obesity and DM

BMI	DM(+)	DM (-)	Total
Obese	6	11	17
Normal	15	125	140

RR = 3.2

In my study obesity is associated with more than a three fold increased risk of Diabetes compared with normal BMI.

Table 13.2

Overweight and DM

BMI	DM (+)	DM (-)	Total
overweight	16	46	62
Normal	15	125	140

RR = 2.4

In my study overweight women are associated with more than a twofold increased risk of Diabetes compared with normal BMI.

Table 13.3

Underweight and DM

BMI	DM(+)	DM(-)	Total
Underweight	1	33	34
Normal	15	125	140

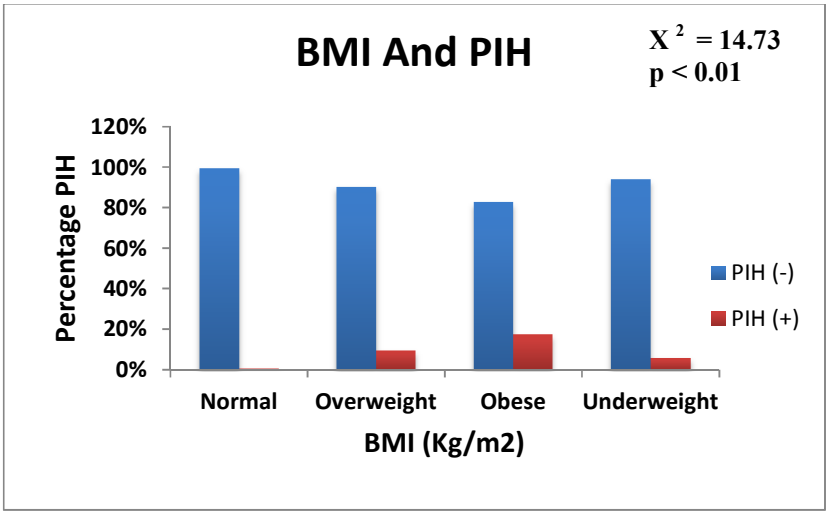
RR = 0.2

In my study Underweight women are not associated with an increased risk of Diabetes.

Table 14 : Association between BMI and Pregnancy Induced Hypertension

BMI (kg/m2)		PIH		Total
		PIH (-)	PIH (+)	
Normal	Number	139	1	140
	%	99.3%	0.7%	100.0%
Overweight	Number	56	6	62
	%	90.3%	9.7%	100.0%
Obese	Number	14	3	17
	%	82.4%	17.6%	100.0%
Underweight	Number	32	2	34
	%	94.1%	5.9%	100.0%
Total	Number	241	12	253
	%	95.3%	4.7%	100.0%

Figure 8: Association between BMI and PIH



In my study maximum number of obese patients (17. 6 %) developed PIH, when compared to women of normal BMI(0. 7%).Analysis was done using Chi-square. Results showed a strong association between BMI and PIH($X^2 = 14.73$, $p < 0.01$)

RELATIVE RISK

Table 14.1 Obesity and PIH

BMI	PIH (+)	PIH (-)	Total
OBESE	3	14	17
NORMAL	1	139	140

RR = 25.1

In my study obesity is associated with more than a twenty five fold increased risk of PIH compared with normal BMI.

Table 14.2 Overweight and PIH

BMI	PIH (+)	PIH (-)	Total
Overweight	6	56	62
Normal	1	139	140

RR = 13.7

In my study overweight women are associated with more than a thirteen fold increased risk of PIH compared with normal BMI women.

Table 14.3 Underweight and PIH

BMI	PIH (+)	PIH (-)	Total
Underweight	2	32	34
Normal	1	139	140

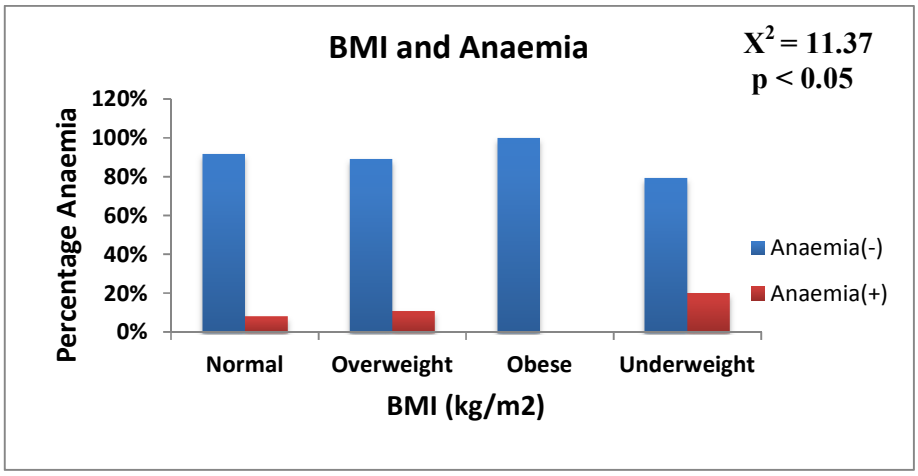
RR = 8.2

In my study underweight women are associated with more than an eight fold increased risk of PIH compared with normal BMI.

Table 15 :Association between Anemia and BMI

BMI		Anaemia		Total
		Anaemia(-)	Anaemia(+)	
Normal	Number	128	12	140
	%	91.4%	8.6%	100.0%
Overweight	Number	55	7	62
	%	88.7%	11.3%	100.0%
Obese	Number	17	0	17
	%	100.0%	.0%	100.0%
Underweight	Number	27	7	34
	%	79.4%	20.6%	100.0%
Total	Number	227	26	253
	%	89.7%	10.3%	100.0%

Figure 9 : Association between BMI and Anaemia



In my study a maximum percentage of Underweight women 0.6 %) developed Anemia, followed by overweight women (11.3%), when compared to the normal BMI group (8.6 %) .

Analysis was done using Chi square . Results showed a significant association between BMI and anemia in my study. (X^2 = 11.37, $p < 0.05$)

RELATIVE RISK

Table 15.1Obesity and Anemia

BMI	Anemia(+)	Anemia(-)	Total
Obese	0	17	17
Normal	12	128	140

In my study none of the obese individuals developed Anemia, so the relative risk could not be calculated.

Table 15.2Overweight and Anemia

BMI	Anemia(+)	Anemia(-)	Total
Overweight	7	55	62
Normal	12	128	140

RR = 1.31

In my study overweight women are associated with more than a one fold increased risk of Anemia compared with normal BMI women.

Table 15.3 Underweight and Anemia

BMI	Anemia (+)	Anemia (-)	Total
Underweight	7	27	34
Normal	12	128	140

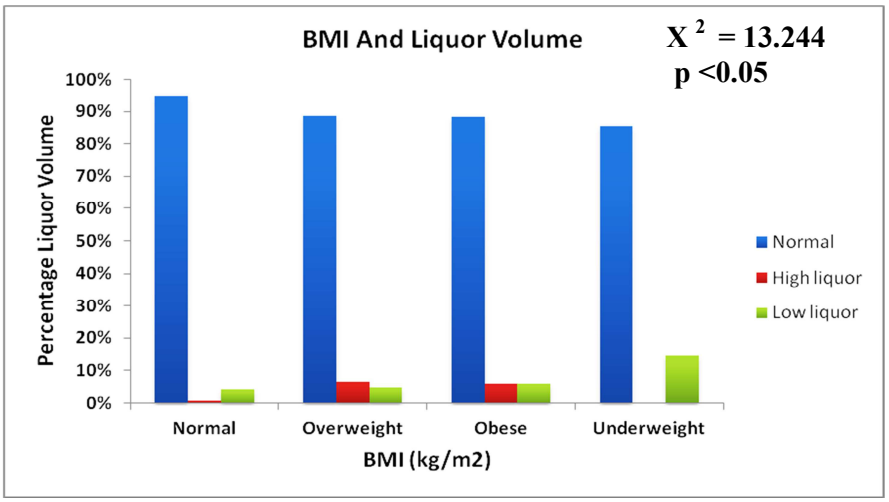
RR = 2.4

In my study underweight people are associated with more than a two fold increased risk of Anemia compared with normal BMI.

TABLE 16: Association between Liquor volume and BMI

BMI		Liquor Volume			Total
		Normal	High liquor	Low liquor	
Normal	Number	133	1	6	140
	%	95.0%	.7%	4.3%	100.0%
Overweight	Number	55	4	3	62
	%	88.7%	6.5%	4.8%	100.0%
Obese	Number	15	1	1	17
	%	88.2%	5.9%	5.9%	100.0%
Underweight	Number	29	0	5	34
	%	85.3%	.0%	14.7%	100.0%
Total	Number	232	6	15	253
	%	91.7%	2.4%	5.9%	100.0%

Figure 10 : Association between BMI and Liquor volume



Analysis was done. In my study, maximum number of patients with increased BMI(12.4%) had polyhydraminos, whereas maximum number of underweight patients (14.7%) had oligohydraminos. Using Chi square analysis, it was found that there was a strong association between BMI and liquor volume.($X^2 = 13.244$, $p < 0.05$)

RELATIVE RISK

Table 16.1 Obesity and Polyhydraminos

BMI	Polyhydraminos(+)	Polyhydraminos(-)	Total
Obese	1	15	16
Normal	1	133	134

RR = 8.8

In my study Obesity is associated with more than an eight fold increased risk of polyhydraminos compared with normal BMI.

Table 16.2 Overweight and Polyhydraminos

BMI	Polyhydraminos(+)	Polyhydraminos(-)	Total
overweight	4	55	59
normal	1	133	134

RR = 9.7

In my study Overweight women are associated with a nine fold increased risk of polyhydraminos compared with normal BMI.

Table 16.3 Underweight and Polyhyraminos

BMI	Polyhydraminos(+)	Polyhydraminos(-)	Total
Underweight	0	29	29
Normal	1	133	134

In my study none of the women in the Underweight group had polyhydraminos so the relative risk could not be calculated.

Table 16.4 Obesity and Oligohydraminos

BMI	Oligohydraminos(+)	Oligohydraminos(-)	Total
Obese	1	15	16
Normal	6	133	139

RR =1.44

In my study Obesity is associated with a one fold increased risk of oligohydraminos compared with normal BMI.

Table 16.5 Overweight and Oligohydraminos

BMI	Oligohydraminos(+)	Oligohydraminos(-)	Total
Overweight	3	55	58
Normal	6	133	139

RR = 1.1

In my study Overweight women are associated with a one fold increased risk of oligohydraminos compared with normal BMI.

Table 16.6 Underweight and oligohydraminos

BMI	Oligohydraminos(+)	Oligohydraminos(-)	Total
Underweight	5	29	34
Normal	6	133	139

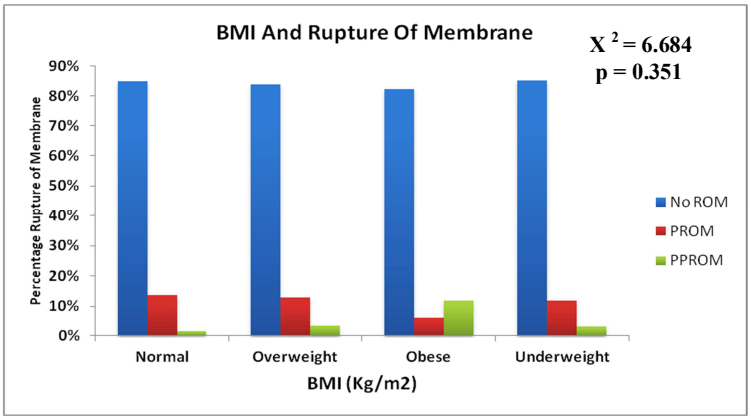
RR = 3.4

In my study Underweight is associated with more than a three fold increased risk of oligohydraminos compared with normal BMI.

Table 17 : Association between BMI and Rupture of Membrane(ROM)

BMI		RUPTURE OF MEMBRANE(ROM)			Total
		No ROM	PROM	PPROM	
Normal	Number	119	19	2	140
	%	85.0%	13.6%	1.4%	100.0%
Overweight	Number	52	8	2	62
	%	83.9%	12.9%	3.2%	100.0%
Obese	Number	14	1	2	17
	%	82.4%	5.9%	11.8%	100.0%
Underweight	Number	29	4	1	34
	%	85.3%	11.8%	2.9%	100.0%
Total	Number	214	32	7	253
	%	84.6%	12.6%	2.8%	100.0%

Figure 11 :Association between BMI and Rupture of Membrane



Analysis was done. From the results it showed that there was no significant difference between any of the BMI groups regarding PROM. In my study, maximum number of obese patients(11.8 %) had PPROM when compared to other groups. Using Chi square analysis, it was found that the association between BMI and Rupture of Membranes(ROM) was not significant in my study. (X^2 = 6.684, p = 0.351)

Relative Risk

Table 17.1 Obesity and PROM

BMI	PROM(+)	PROM (-)	Total
Obesity	1	14	15
Normal	19	119	138

RR = 0.48

In my study Obesity is not associated with a risk of PROM when compared to women with normal BMI.

Table 17.2 Overweight and PROM

BMI	PROM(+)	PROM (-)	Total
Overweight	8	52	60
Normal	19	119	138

RR = 0.97

In my study Overweight is not associated with a risk of PROM when compared to women with normal BMI.

Table 17.3 Underweight and PROM

BMI	PROM(+)	PROM(-)	Total
Underweight	4	29	33
Normal	9	119	138

RR = 1.86

In my study Underweight women have a one fold increased risk of PROM when compared to women with normal BMI in my study.

Table 17.4 Obesity and PPROM

BMI	PPROM(+)	PPROM (-)	Total
Obese	2	14	16
Normal	2	119	121

RR = 7.8

In my study Obesity is associated with more than a seven fold increased risk of PPROM compared with normal BMI. Though my study showed no association between BMI and PPROM, the risk of obese women having PPROM showed a seven fold increase in risk.

Table 17.5 Overweight and PPROM

BMI	PPROM(+)	PPROM (-)	Total
overweight	2	52	54
Normal	2	119	121

RR = 2.13

In my study Overweight women are associated with more than a two fold increased risk of PPROM compared with normal BMI.

Table 17.6 Underweight and PPROM

BMI	PPROM(+)	PPROM (-)	Total
Underweight	1	29	30
Normal	2	119	121

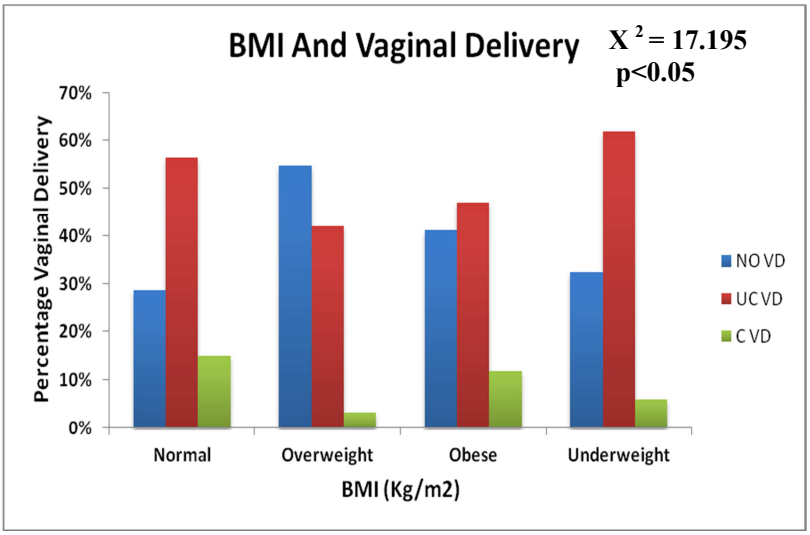
RR = 2.06

In my study Underweight women are associated with more than a two fold increased risk of PPROM compared with normal BMI.

Table 18 : Association between BMI and Vaginal delivery

BMI		VAGINAL DELIVERY(VD)			Total
		NO VD	UC VD	C VD	
Normal	Number	42	79	19	140
	%	30.0%	56.4%	13.6%	100.0%
overweight	Number	34	26	2	62
	%	54.8%	41.9%	3.2%	100.0%
Obese	Number	7	8	2	17
	%	41.2%	47.1%	11.8%	100.0%
underweight	Number	11	21	2	34
	%	32.4%	61.8%	5.9%	100.0%
Total	Number	94	134	25	253
	%	36.4%	53.0%	10.7%	100.0%

Figure 12 :Association between BMI and Vaginal delivery



Results were analyzed. It can be seen that subjects falling into the normal and underweight groups have undergone a higher percentage of uncomplicated vaginal deliveries as compared to the overweight and obese groups. Using Chi square analysis, it was found that there was a strong association Between BMI and vaginal delivery.($X^2 = 17.195$, $p<0.05$)

Relative Risk

Table 18.1 Obesity and Complicated vaginal delivery(CVD)

BMI	CVD(+)	CVD (-)	Total
Obesity	2	8	10
Normal	19	79	98

RR = 1.03

Obesity is associated with more than a one fold increased risk of complicated vaginal delivery compared to women of normal BMI.

Table 18.2 Overweight and Complicated vaginal delivery

BMI	CVD(+)	CVD(-)	Total
Overweight	2	26	28
Normal	19	79	98

RR = 0.3

In my study overweight women are not at a increased risk of complicated vaginal delivery compared to women of normal BMI.

Table 18.3 Underweight and Complicated vaginal delivery

BMI	CVD (+)	CVD (-)	Total
Underweight	2	21	23
Normal	19	79	98

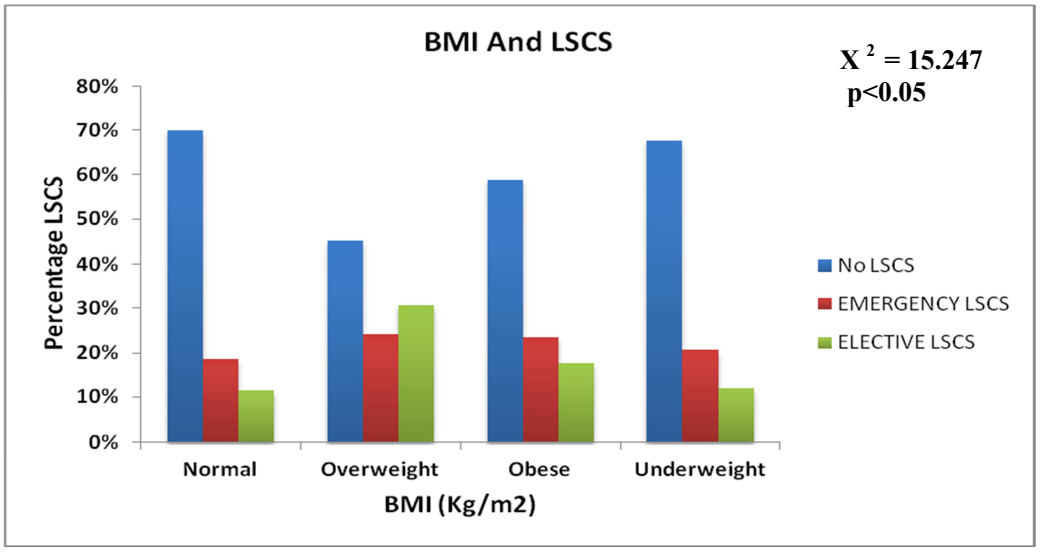
RR = 0.44

Underweight women are not at an increased risk of complicated vaginal delivery in my study compared to women with normal BMI.

Table 19 : Association between BMI and LSCS

BMI		LSCS			Total
		No LSCS	Emergency LSCS	Elective LSCS	
Normal	Number	98	26	16	140
	%	70.0%	18.6%	11.4%	100.0%
Overweight	Number	28	15	19	62
	%	45.2%	24.2%	30.6%	100.0%
Obese	Number	10	4	3	17
	%	58.8%	23.5%	17.6%	100.0%
Underweight	Number	23	7	4	34
	%	67.6%	20.6%	11.8%	100.0%
Total	Number	159	52	42	253
	%	62.8%	20.6%	16.6%	100.0%

Figure 13 :Association between BMI and LSCS



Results were analyzed. It can be seen that a much higher percentage of overweight and obese group subjects have had C section either in the form of emergency or elective when compared to normal group individuals. Using Chi square analysis, it was found that there was a strong association between BMI and Cesarean section.(X^2 = 15.247, $p<0.05$)

Relative Risk

Table 19.1 Obesity and LSCS

BMI	LSCS(+)	LSCS(-)	Total
Obese	7	10	17
Normal	42	98	140

RR = 1.37

Obese women are at a one fold increased risk of undergoing LSCS when compared to women with normal BMI.

Table 19.2 Overweight and LSCS

BMI	LSCS(+)	LSCS(-)	Total
Overweight	34	28	62
Normal	42	98	140

RR = 1.8

Overweight women are at a one fold increased risk of undergoing LSCS when compared to women with normal BMI.

Table 19.3 Underweight and LSCS

BMI	LSCS(+)	LSCS(-)	Total
Underweight	11	23	34
Normal	42	98	140

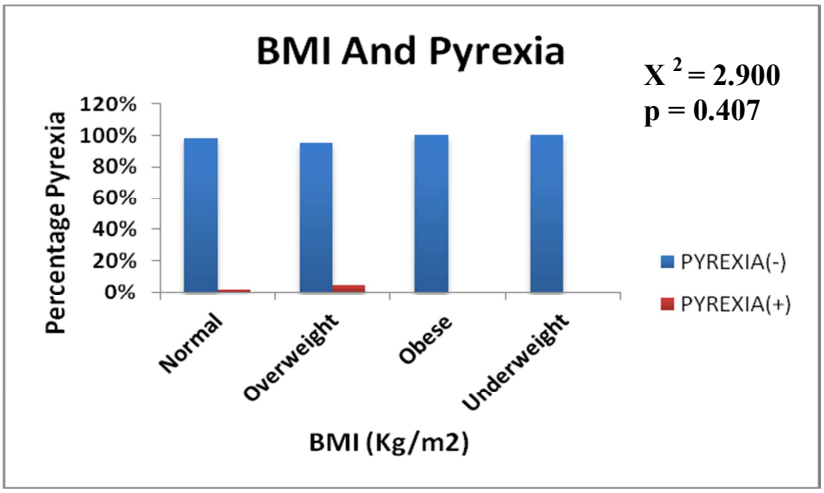
RR = 1.07

In my study underweight women are at a one fold increased risk of undergoing LSCS when compared to women with normal BMI.

Table 20 : Association between BMI and Pyrexia

BMI		Pyrexia		Total
		PYREXIA (-)	PYREXIA (+)	
Normal	Number	137	3	140
	%	97.9%	2.1%	100.0%
Overweight	Number	59	3	62
	%	95.2%	4.8%	100.0%
Obese	Number	17	0	17
	%	100.0%	.0%	100.0%
Underweight	Number	34	0	34
	%	100.0%	.0%	100.0%
Total	Number	247	6	253
	%	97.6%	2.4%	100.0%

Figure14 : Association between BMI and Pyrexia



Results were analyzed. In my study Overweight women had a higher percentage of complications like pyrexia compared to normal BMI group but obese and underweight women had no pyrexia. Using Chi square analysis, it was found that there was no association between BMI and pyrexia in my study.($X^2 = 2.900$, $p = 0.407$)

Table 20.1 Overweight and PYREXIA

BMI	PYREXIA (+)	PYREXIA (-)	Total
Overweight	3	59	62
Normal	3	137	140

RR = 2.26

In my study, overweight women have a two fold increase in Pyrexia compared to women with normal BMI.

Table 20.2 Obesity and PYREXIA

BMI	PYREXIA (+)	PYREXIA (-)	Total
Obese	0	17	17
Normal	3	137	140

In my study relative risk could not be calculated as none of the obese patients had pyrexia.

Table 20.3 Underweight and PYREXIA

BMI	PYREXIA (+)	PYREXIA (-)	Total
Underweight	0	34	34
Normal	3	137	140

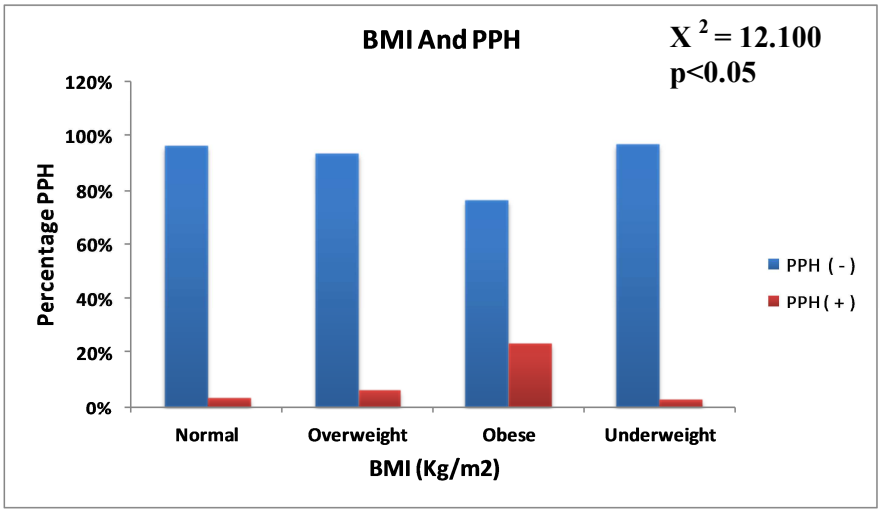
In my study, none of the underweight women had, pyrexia, and so the relative risk could not be calculated

Table 21 :Association between PPH and BMI

BMI		Postpartum Haemorrhage(PPH)		Total
		PPH (-)	PPH (+)	
Normal	Number	135	5	140
	%	96.4%	3.6%	100.0%
Overweight	Number	58	4	62
	%	93.5%	6.5%	100.0%
Obese	Number	13	4	17
	%	76.5%	23.5%	100.0%
Underweight	Number	33	1	34
	%	97.1%	2.9%	100.0%
Total	Number	239	14	253
	%	94.5%	5.5%	100.0%

Results were analyzed. It was found that obese and overweight women had a higher percentage of Post partum haemorrhage(PPH) when compared to the normal and underweight groups.

Figure 15 : Association between PPH and BMI



Using Chi square analysis, it was found that there was a strong association between BMI and PPH.($X^2 = 12.100$, $p<0.05$)

RELATIVE RISK

Table 21.1 Overweight and PPH

BMI	PPH (+)	PPH (-)	Total
Overweight	4	58	62
Normal	5	135	140

RR = 1.81

In my study, overweight women had more than a one fold increased in PPH when compared to women with normal BMI.

Table 21.2 Obesity and PPH

BMI	PPH (+)	PPH (-)	Total
Obese	4	13	17
Normal	5	135	140

RR = 6.59

In my study, obesity has a six fold increase in the risk of PPH when compared to women with normal BMI

Table 21.3 Underweight and PPH

BMI	PPH (+)	PPH (-)	Total
Underweight	1	33	34
Normal	5	135	140

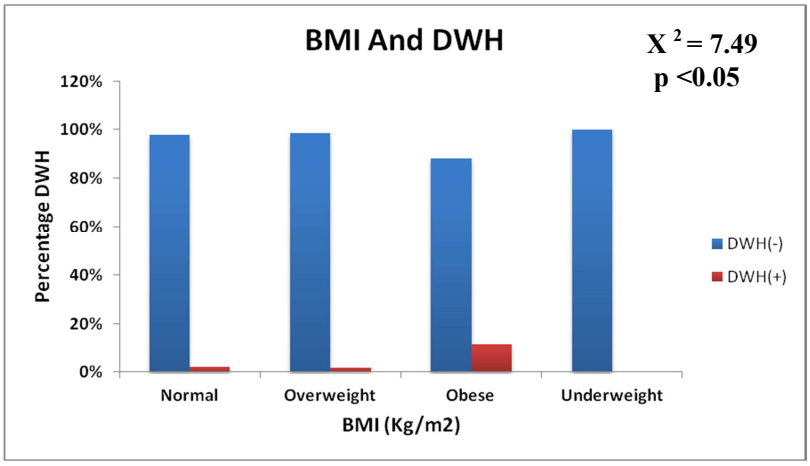
RR=0.82

In my study, underweight women do not have an increased risk of PPH when compared to women with normal BMI.

Table 22: Association between Delayed Wound Healing and BMI

BMI		Delayed Wound healing(DWH)		Total
		DWH (-)	DWH (+)	
Normal	Number	137	3	140
	%	97.9%	2.1%	100.0%
overweight	Number	61	1	62
	%	98.4%	1.6%	100.0%
Obese	Number	15	2	17
	%	88.2%	11.8%	100.0%
underweight	Number	34	0	34
	%	100.0%	.0%	100.0%
Total	Number	247	6	253
	%	97.6%	2.4%	100.0%

Figure 16 :Association between BMI and Delayed Wound Healing



Results were analyzed. It was seen that the percentage of delayed wound healing was much higher in the obese group women when compared with the other groups. Using Chi square analysis, it was found that there was an association between BMI and delayed wound healing.($X^2 = 7.49$, $p < 0.05$)

Relative Risk

Table 22.1 Overweight and DWH

BMI	DWH (+)	DWH (-)	Total
Overweight	1	61	62
Normal	3	137	140

RR = 0.75

In my study, overweight women do not have a risk of delayed wound healing when compared to normal BMI women

Table 22.2 Obesity and DWH

BMI	DWH (+)	DWH (-)	Total
Obese	2	15	17
Normal	3	137	140

RR = 5.49

In my study, obese women have a five fold increase of delayed wound healing when compared to normal BMI women.

Table 22.3 Underweight and DWH

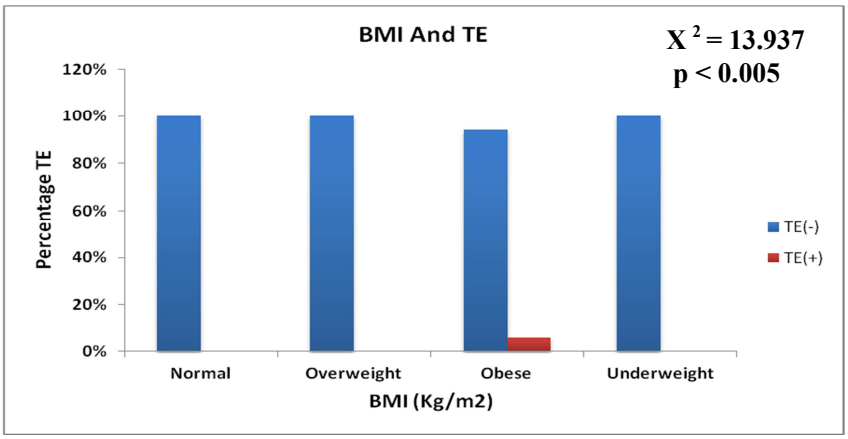
BMI	DWH (+)	DWH (-)	Total
Underweight	0	34	34
Normal	3	137	140

In my study, underweight women have a risk of delayed wound healing when compared to normal BMI women.

Table 23 : Association between Thromboembolism and BMI

BMI		THROMBOEMBOLISM(TE)		Total
		TE (-)	TE (+)	
Normal	Number	140	0	140
	%	100.0%	.0%	100.0%
Overweight	Number	62	0	62
	%	100.0%	.0%	100.0%
Obese	Number	16	1	17
	%	94.1%	5.9%	100.0%
Underweight	Number	34	0	34
	%	100.0%	.0%	100.0%
Total	Number	252	1	253
	%	99.6%	.4%	100.0%

Figure 17: Association between BMI and TE

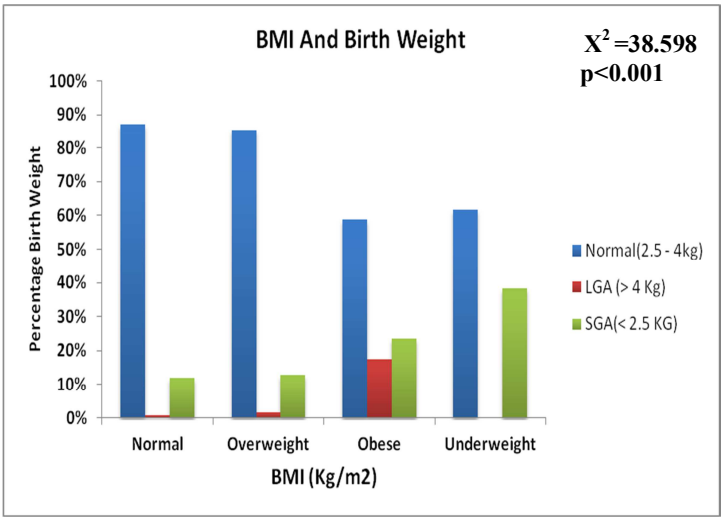


Results were analyzed. It was seen that thromboembolism as a complication occurred in the obese BMI group compared to the normal BMI group. Using Chi square analysis, it was seen that there was a strong association between BMI and thromboembolism. ($X^2 = 13.937$, $p < 0.005$) Only one patient in the whole study group of 253, belonging to the obese BMI group developed thromboembolism, and so relative risk could not be calculated due to a very small number.

Table 24 : Association between BMI and Birth weight

BMI		Birth weight			Total
		Normal (2.5 - 4 kg)	LGA (> 4 KG)	SGA (< 2.5 KG)	
Normal	Number	122	1	17	140
	%	87.1%	.7%	12.1%	100.0%
Overweight	Number	53	1	8	62
	%	85.5%	1.6%	12.9%	100.0%
Obese	Number	10	3	4	17
	%	58.8%	17.6%	23.5%	100.0%
underweight	Number	21	0	13	34
	%	61.8%	.0%	38.2%	100.0%
Total	Number	206	5	42	253
	%	81.4%	2.0%	16.6%	100.0%

Figure 18:Association between BMI and Birth weight



Results were analyzed. It was seen that maximum percentage of LGA babies were born to obese women compared to women with normal BMI. Likewise maximum percentage of SGA babies were born to women in the underweight group. Pearson Chi square analysis was performed. It showed that there was a significant association between BMI and birth weight. (X^2 =38.598, p<0.001).

Table 24.1Overweight and SGA

BMI	SGA(+)	SGA(-)	Total
Overweight	8	53	61
Normal	17	122	139

RR = 1.07

In my study, overweight women had a one fold increased risk of having SGA babies, compared to women with normal BMI.

Table 24.2 Obese and SGA

BMI	SGA(+)	SGA(-)	Total
Obese	4	10	14
Normal	17	122	139

RR = 2.34

In my study, obese women had a two fold increased risk of having SGA babies compared to women with normal BMI.

Table 24.3 Underweight and SGA

BMI	SGA(+)	SGA(-)	Total
Underweight	13	21	34
Normal	17	122	139

RR = 3.13

In my study, underweight women are associated with a three fold increased risk of delivering SGA babies compared to normal BMI group.

Table 24.4 Obese and LGA

BMI	LGA(+)	LGA(-)	Total
Obese	3	10	13
Normal	1	122	123

RR = 28.38

Obese women have a twenty eight fold increased risk in delivering LGA babies compared to women with normal BMI.

Table 24.5 Overweight and LGA

BMI	LGA(+)	LGA(-)	Total
Overweight	1	53	54
Normal	1	122	123

RR = 2.28

Overweight women have a two fold increased risk in delivering LGA babies.

Table 24.6 Underweight And LGA

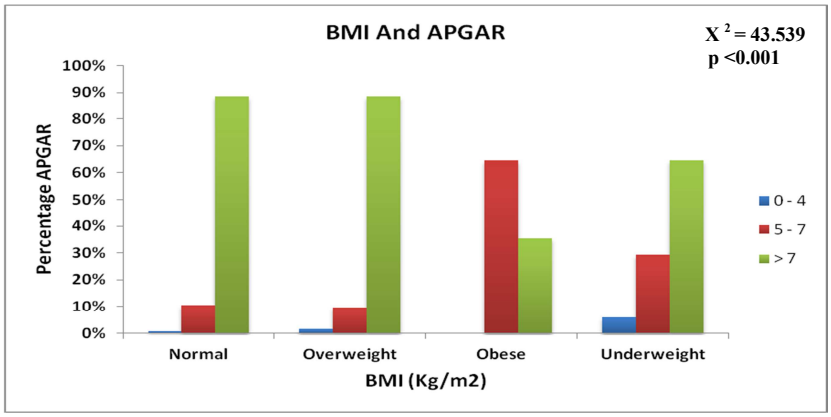
BMI	LGA(+)	LGA(-)	Total
Underweight	0	21	21
Normal	1	122	123

None of the underweight women delivered LGA babies in my study and hence relative risk could not be calculated.

Table 25 :Association between Apgar Score And BMI

BMI		APGAR			Total
		0 - 4	5 - 7	> 7	
Normal	Number	1	15	124	140
	%	.7%	10.7%	88.6%	100.0%
Overweight	Number	1	6	55	62
	%	1.6%	9.7%	88.7%	100.0%
Obese	Number	0	11	6	17
	%	.0%	64.7%	35.3%	100.0%
Underweight	Number	2	10	22	34
	%	5.9%	29.4%	64.7%	100.0%
Total	Number	4	42	207	253
	%	1.6%	16.6%	81.8%	100.0%

Figure 19 : Association between BMI and Apgar



Results were analyzed. It was seen that low Apgar score was seen in babies born to Underweight and obese women(extremes of BMI) when compared to women in the normal BMI group having a much higher percentage of babies with good Apgar score. Pearson Chi square analysis was performed. It showed a strong and highly Significant association between BMI and Apgar score ($X^2 = 43.539$, $p < 0.001$).

Relative Risk

Table 25.1 Obesity and Low Apgar

BMI	Low Apgar(+)	Low Apgar (-)	Total
Obese	11	6	17
Normal	16	124	140

RR = 5.6

In my study obese women are at a five fold increased risk of giving birth to babies with a Low Apgar score when compared to women with normal BMI.

Table 25.2 Overweight and Low Apgar

BMI	Low Apgar(+)	Low Apgar (-)	Total
Overweight	7	55	62
Normal	16	124	140

RR = 0.9

In my study. Overweight women are not at an increased risk of delivering babies with Low Apgar score.

Table 25.3 Underweight and Low Apgar

BMI	Low Apgar (+)	Low Apgar (-)	Total
Underweight	12	22	34
Normal	16	124	140

RR = 3.08

Underweight women are at a three fold increased risk of delivery babies with a Low Apgar score when compared to women with normal BMI.

Discussion

DISCUSSION

A Prospective observational study comprising 253 antenatal women with singleton uncomplicated pregnancies, booked at PSG Hospital within the first 12 weeks of gestation and delivering at term has been conducted during the period of September 2103-August 2014.

The age of the subjects in the present study were in the range of 18– 40 years. The mean age of the subjects was 25 years.

In the study, 53.8% of the study population were nullipara and 46.2% were multipara.

92.1 % of the subjects were term patients with gestational age 37- 40 weeks and 7.9 % of the subjects were preterm patients with gestational age less than 37 weeks.

It was seen that 17.4 % of the subjects showed a weight gain of 0 – 7 kg. 53 % of the subjects showed a weight gain of 8 – 13 kg during pregnancy. 29.6 % of the women showed a weight gain of more than 13 kg.

The study comprised women, who were divided into four BMI groups based on their early pregnancy BMI. The BMI at presentation of <18.5 kg/m^2 was seen in 13.4% of the population.

BMI between 18.5 - 24.9 kg/m^2 was seen in 55.3% of the women. BMI between 25.0 - 29.9 kg/m^2 was seen in 24.5 % of the women. BMI of $30kg/m^2$ and above was seen in 6.7 % of the women.

Majority of the women (55.3 %) in the study population belonged to the normal BMI group and the overweight and obese group together comprised as large as 31.2 %. This is of significance as with changing lifestyle, obesity is increasing rapidly especially in urban set ups and may become a major health problem in the future.

Maximum weight gain was noticed in a large number of obese individuals, whereas minimum weight gain was seen in underweight women. Association of gestational weight gain and BMI was done using Chi- square tests and it was seen that weight gain was significantly associated with early pregnancy BMI.($p<0.01$) A similar study done by Ihunnya O Frederick et al, observed that obese women gained more weight while underweight women gained less weight in pregnancy $p < 0.001$.[2] In another study by J.E.Brown et al, results suggested that underweight women who gained less weight in pregnancy had a lower birth weight neonate and obese women delivered big babies.[44] Therefore adequate weight gain is of critical importance during pregnancy, the deficiency or excess of which leads to adverse pregnancy outcomes. Antenatal women should

hence be encouraged to follow the IOM recommendations regarding total weight gain based on pre pregnant BMI.[33,34]

In the present study, 10.7 % of the patients in the Normal BMI group developed DM. 25.8 % in the overweight BMI group developed DM. 35.3 % of the patients in the obese BMI group developed DM. In the underweight BMI group only 1 % developed DM.

Maximum number of patients in the obese group developed DM(35.3 %) and minimum number of patients in the underweight group developed DM(1 %).

Association between Diabetes Mellitus and BMI was performed using Chi-Square analysis and it has been shown that Diabetes Mellitus is significantly associated with increasing BMI ($p< 0.01$). A study conducted by D.A. Dohertya on 331 women found that 188 women were obese (6.6%) and that obese women were more likely to develop gestational diabetes ($p<0.001$). [45]

Upon calculating the relative risk it was seen that maximum risk of acquiring Diabetes is seen in obese women (3 fold) compared with normal BMI women , overweight women were

associated with a two fold increase and underweight women showing no increased risk of acquiring Diabetes.

In the current study, it was seen that 0.7 % of the subjects belonging to the Normal BMI group developed PIH. 5.9 % in the underweight group developed PIH. 9.7 % in the overweight BMI group developed PIH and 17.6 % in the obese group were seen to develop PIH.

Maximum number of obese patients (17. 6 %) developed PIH, compared to women of normal BMI(0.7 %)Analysis was done using Chi-square, which showed a strong association between increasing BMI and PIH.($p < 0.01$) A similar study done by Meenakshi, Srivastava Reena(FOGSI) [1] showed that obese women were associated with adverse outcomes like PIH with a $p < 0.05$.

Upon calculating the relative risk, maximum risk of acquiring PIH is seen in obese women (25 fold)compared with normal BMI. Overweight women are at a thirteen fold increased risk of PIH compared with normal BMI women, whereas underweight women are at an eight fold increased risk of PIH than normal BMI women.

It was observed that, 8.6 % with Normal BMI developed anemia. 11.3 % of the subjects in the overweight group developed

anemia. No patients in the obese group developed anemia. 20.6 % of the underweight patients developed anemia.

Maximum percentage of Underweight women (20.6 %) developed Anemia, followed by overweight women (11.3%), when compared to the normal BMI group (8.6 %) .

Analysis was done using Chi square, which showed a significant association between low BMI and anemia in my study. ($p< 0.05$). A study done by Adam I, [46] on 1136 showed that 26.5% of the underweight women developed anemia with a significant association between anemia and low BMI being $p < 0.05$

In the present study none of the obese individuals developed Anemia, so the relative risk could not be calculated. It was seen that overweight women had a one fold increased risk of Anemia , but the underweight women showed the maximum risk of developing Anemia(two fold)compared with normal BMI individuals.

Importance has to be given, because ours is a developing country, and the incidence of Anemia is high especially in the rural areas.

In the current study, 6.5 % of the overweight patients had Polyhydraminos, whereas 5.9 % of the obese patients had polyhydraminos when compared to patients belonging to the normal BMI group(0.7 %). In the underweight category, none of the patients had polyhydraminos, but maximum number of patients in the underweight group had oligohydraminos(14.7 %) when compared with the normal BMI category (4.3 %) .

It was seen that maximum number of patients with increased BMI had polyhydraminos, whereas maximum number of underweight patients had oligohydraminos.

Using Chi - square test, it was found that there was an association between BMI and liquor volume.($p < 0.05$).

Upon calculating the relative risk, it was found that Obese women had an eight fold increased risk of polyhydraminos compared with normal BMI while Overweight women were found to have a nine fold increased risk of polyhydraminos compared with normal BMI. No patients in the Underweight group had polyhydraminos so the relative risk could not be calculated.

It was observed that maximum risk of oligohydraminos was seen in the Underweight group (three fold) compared with normal BMI.

Results showed that 12.9 % of the overweight patients had PROM whereas 5.9% of the obese patients had PROM when compared to patients belonging to the normal BMI group who comprised of 13.6 %. In the underweight category, 11.8 % of the patients had PROM, when compared with normal BMI women(13.6 %) .

From the results, it can be seen that there was no significant difference in various BMI groups regarding PROM in the study (p= 0.35) A similar study done by Meenakshi, Srivastava Reena(FOGSI) [1] showed that no significant difference was noted among obese women regarding PROM with a $p > 0.05$.

Regarding PPROM, results showed that 3.2 % of the overweight patients had PPROM, whereas 11.8 % of the obese patients had PPROM when compared to patients belonging to the normal BMI group who comprised only 1.4 %. In the underweight category, 2.9 % of the patients had PPROM .

From the results, it showed that maximum number of obese patients (11.8 %) had PPROM when compared to other BMI groups.

Using Chi square analysis, it was found that the association between BMI and Rupture of Membranes(ROM) was not significant in my study. (p =0.351)

Upon calculating the relative risk, it was seen that underweight , overweight and obese women did not have an increased risk of PROM, while maximum number of Obese patients are at an increased risk of PPROM(7 fold) compared with normal BMI.

Though my study showed no significant association between BMI and ROM(p=0.35) the risk of obese women having PPROM showed a seven fold increase.

In the study, it was seen that subjects in the normal(56.4%) and underweight(61.8%) groups had a higher percentage of uncomplicated vaginal deliveries when compared to the overweight(41.9%) and obese(47.1%) groups. But the maximum number of patients having a complicated vaginal delivery fell in the obese group and also the maximum number of patients in the obese (41.2%) and overweight (54.8%) groups did not have a

vaginal delivery when compared to the other two groups respectively.

Using Chi square analysis, it was found that there was a strong association between BMI and vaginal delivery.($p<0.05$) A study done on 215 women by Meenakshi, Srivastava Reena(FOGSI) [1] showed that 18 obese women were associated with complicated vaginal deliveries with a $p < 0.05$.

Obese women were at a one fold increased risk of complicated vaginal delivery when compared to women of normal BMI, while both overweight and underweight women were not shown to be at an increased risk of complicated vaginal delivery in my study when compared to women with normal BMI.

In my study it can be seen that a much higher percentage of overweight (54.8%)and obese group (41.1%) subjects have had C section either in the form of emergency or elective when compared to normal group individuals.

Using Chi square analysis, it was found that there was a strong association between BMI and Cesarean section.($p<0.05$).) A study done on 215 women by Meenakshi, Srivastava Reena(FOGSI) [1]

showed that 79 out of 170 obese women were associated with Cesarean sections with a $p < 0.01$.

In my study all the 3 groups are at a one fold increased risk of undergoing LSCS when compared to women with normal BMI.

In my study Overweight women(4.8%) had a higher percentage of complications like pyrexia compared to normal BMI group(2.1%) but obese and underweight women had no pyrexia.

Using Chi square analysis, it was found that there was no association between BMI and pyrexia in my study.($p = 0.407$)

In my study, overweight women have a two fold increase in Pyrexia compared to women with normal BMI. The relative risk for obese and underweight women could not be calculated as none of the women in these groups had pyrexia.

In my study, it was found that obese(23.5%) and overweight women(6.5%) had a higher percentage of Post partum hemorrhage(PPH) when compared to the normal(3.6%) and underweight groups.(2.9%)

Using Chi square analysis, it was found that there was a strong association between BMI and PPH.($p<0.05$). A study done by Meenakshi, Srivastava Reena(FOGSI) [1] showed that only 5 out of 170 obese and overweight women developed PPH with a $p > 0.05$,

showing no significant association between PPH and increasing BMI, while our study showed a significant association between BMI and PPH. ($P < 0.05$)

In the present study, the maximum number of obese patients have an increased risk of PPH(6 fold) when compared to women with normal BMI. Overweight women have a one fold increase in the risk of PPH, whereas underweight women do not have an increased risk of PPH when compared to women with normal BMI.

The percentage of delayed wound healing was much higher in the obese groups (11.8%) women when compared with the other groups.

Using Chi square test, it was found that there was an association between BMI and delayed wound healing.($X^2 = 7.49$, $p<0.05$) A study done on 215 women by Meenakshi, Srivastava Reena(FOGSI) [1] showed that 25 out of 170 obese and overweight women were associated with delayed wound healing with a $p < 0.05$.

In the current study, obese women have a five fold increase in risk of delayed wound healing when compared to normal BMI

women, whereas overweight and underweight women do not have a risk of delayed wound healing.

Thromboembolism as a complication occurred only in the obese BMI group(5.9%).

Using Chi square analysis, it was seen that there was a strong association between BMI and thromboembolism. ($X^2 = 13.937$, $p < 0.005$)

The relative risk could not be calculated for Thromboembolism because only one patient in the study group of 253 belonging to the obese BMI group developed thromboembolism. But from the p value, it can be seen that there is a significant association between BMI and thromboembolism.

In the present study, it was seen that maximum percentage of LGA babies were born to obese women(17.6%) compared to women with normal BMI. Likewise maximum percentage of SGA babies were born to women in the underweight group(38.2%) when compared to other groups. Results showed that there was a significant association between lower BMI and low birth weight and obesity and high birth weight. ($p<0.001$). Similar findings were noted in a study by Ihunnaya O Frederick et al[2] and J.E.Brown et al[44]

with $p<0.001$ and p value 0.0009 respectively. Study done on 215 women by Meenakshi, Srivastava Reena(FOGSI) [1] showed that 66 out of 170 obese and overweight women were delivered babies with low Apgar score with a $p < 0.05$.

In my study, women in the underweight group had the maximum increase in risk(3 fold) of delivering a SGA baby, whereas overweight had a one fold increase and obese women had a two fold increased risk when compared to the normal BMI group.

The maximum percentage of patients at risk of delivering LGA babies were obese patients who had a twenty eight fold(28 fold) , whereas overweight patients had a one fold increase in risk and underweight had no risk in delivering LGA babies when compared to the normal BMI.

In my study, it was seen that low Apgar score was seen in babies born to Underweight(35.3%)and obese women(64.7%) when compared to women in the normal BMI group having a much higher percentage of babies with good Apgar score. (Apgar> 7 – 88.6%).

Pearson Chi square analysis showed that showed a highly significant association between BMI and Apgar score ($p <0.001$).

In the present study obese women are at a five fold increased risk of giving birth to babies with a Low Apgar score, underweight women are at a three fold increased risk and overweight women showed no risk of delivering babies with a Low Apgar score when compared to women with normal BMI.

Maternal nutritional status plays a vital role for the health and quality of life of a pregnant mother and her baby. Early pregnancy BMI and weight gain during pregnancy are important predictors of adverse pregnancy outcomes. In my study, the association between extremes of early pregnancy BMI and adverse maternal and fetal outcomes have been analyzed. It was seen that there was a strong association between BMI and adverse maternal outcomes with a p value <0.05. It was seen that overweight and obese women had a much higher risk of developing adverse maternal outcomes like gestational diabetes, pregnancy induced hypertension, increased liquor volume, PPROM, increased rate of instrumental deliveries and cesarean sections, postpartum complications like post partum hemorrhage delayed wound healing , delivering LGA babies and low Apgar score On the other hand, Underweight women were seen to develop anaemia, reduced liquor volume, increased rate of cesarean sections and deliver SGA and

low Apgar score. Weight gain during pregnancy in relation to BMI was also analyzed.. It was seen that overweight and obese women gained more weight than women with normal BMI, and least weight was gained by underweight women. My study tried to find an association between early pregnancy BMI and weight gain in relation to various pregnancy outcomes, which was justified. The relative risk of various pregnancy outcomes that a patient with high or low BMI can develop has also been evaluated in my study and the results were justified.

Conclusion

Conclusion

Early pregnancy BMI and gestational weight gain have a strong effect on adverse maternal and neonatal outcomes, which is supported by a huge body of literature.

In the present study, it was seen that there was a strong association between BMI and adverse maternal outcomes . Underweight women were seen to develop anemia, reduced liquor volume, increased rate of cesarean sections and deliver SGA with low Apgar score. It was seen that overweight and obese women had a much higher risk of developing adverse maternal outcomes like gestational diabetes, pregnancy induced hypertension, increased liquor volume, PPROM, increased rate of instrumental deliveries and cesarean sections, postpartum complications like post partum haemorrhage delayed wound healing , delivering LGA babies with low Apgar score. It was observed that overweight and obese women gained more weight than women with normal BMI, and least weight was gained by underweight women. The relative risk of various pregnancy outcomes that a patient with high or low BMI can develop was also evaluated and the results were justified.

Utmost importance needs to be given to BMI and the patterns of weight gain during pregnancy, as they are modifiable

risk factors of adverse pregnancy outcomes. One should have basic knowledge and awareness regarding the symptoms and signs of adverse pregnancy outcomes. A better understanding of the complex interrelations between the mother and fetus has led to a vast improvement on antenatal recommendations.

Many studies have been done in the Western countries whereas only few studies have been done on the Asian population. In India, previously the problems during pregnancy were more related to low BMI but with changing lifestyle, obesity is increasing rapidly especially in urban set ups and may become a major health problem in the future. By performing this study it was possible to evaluate the association between BMI and its adverse effect on pregnancy outcome. The relative risk of various pregnancy outcomes that a patient with extremes of BMI can develop was evaluated by doing this study and the results justified.. It was also possible to analyze the association between BMI and gestational weight gain in our Indian set up, the results of all of which are significant.

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Annexure

PROFORMA

NAME:

AGE:

IP/OP NO:

OBSTETRIC SCORE:

LMP:

EDD:

GESTATIONAL AGE:

EARLY PREGNANCY

WEIGHT:

HEIGHT:

BMI:

END OF PREGNANCY WEIGHT GAIN

GENERAL EXAMINATION

BP

Pallor

P/A

INVESTIGATIONS

HB

ANTENATAL COMPLICATIONS

GDM

PIH

ANAEMIA

DELIVERY

TERM

PRETERM

MEMBRANE STATUS

PROM

PPROM

MODE OF DELIVERY

VAGINAL

- UNCOMPLICATED
- INSTRUMENTAL

C.SECTION

- EMERGENCY
- ELECTIVE

POSTNATAL COMPLICATIONS

PYREXIA

POST PARTUM HAEMORRHAGE

DELAYED WOUND HEALING

THROMBOEMBOILSM

INFANT DETAILS

WEIGHT

APGAR SCORE

PSG Institute of Medical Science and Research, Coimbatore
Institutional Human Ethics Committee
INFORMED CONSENT

I , Dr.Aishwarya M Reddy MS.,(OG) postgraduate from the department of Obstetrics and Gynecology of PSG Institue of Medical Science & Research (PSGIMS&R), am carrying out a study on the topic: "EFFECT OF BODY WEIGHT ON PREGNANCY OUTCOME " to under the aegis of the Department of Obstetrics and Gynecology, PSGIMSR

The objectives of this study are: To evaluate the effect of body weight on pregnancy outcome

.

SAMPLE SIZE : 253

STUDY DESIGN : Prospective Observational study

STUDY PERIOD: All antenatal patients with an uncomplicated singleton pregnancy attending the OG OPD in the first trimester of pregnancy between September 2013 to August 2014.

Consent: The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator/s. Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study.

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date: Witness:

ஒப்புதல் படிவம்

தேதி:_____

Dr.ஐஸ்வர்யா ரெட்டி - ஆகிய நான் P.S.G மருத்துவக் கல்லூரியில் மகளிர் நலம் & மகப்பேறு துறையின் கீழ் - தாயின் உடல் எடையால் பிரசவத்தில் ஏற்படும் விளைவுகள் பற்றி ஒரு ஆய்வு மேற்கொள்ள உள்ளேன்.

இந்த ஆய்வில் கிடைக்கும் தகவல்கள் 1 வருடம் பாதுகாக்கப்படும். இவை வேறு எந்த ஆய்விற்கும் பயன்படுத்தப்பட மாட்டாது. எந்த நிலையிலும் உங்களைப்பற்றிய தகவல்கள் யாருக்கும் தெரிவிக்கப்பட மாட்டாது. அவை இரகசியமாக வைக்கப்படும்.

இந்த ஆய்வில் பங்கேற்க ஒப்புக்கொள்வதால் எந்த விதமான பலனும் உங்களுக்கு கிடைக்காது. எந்த நேரத்தில் வேண்டுமானாலும் ஆய்விலிருந்து விலகிக்கொள்ளும் உரிமை உங்களுக்கு உண்டு. ஆய்விலிருந்து விலகிக்கொள்வதால் உங்களுக்கு அளிக்கப்படும் சிகிச்சையில் எந்தவித மாற்றமும் இருக்காது.

இந்த ஆராய்ச்சிக்காக உங்களிடம் சில கேள்விகள் கேட்கப்படும். மேலும் இந்த ஆய்வில் பங்கு கொள்வது உங்கள் சொந்த விருப்பம். இதில் எந்த விதக் கட்டாயமும் இல்லை. நீங்கள் விருப்பப்பட்டால் இந்த ஆய்வின் முடிவுகள் உங்களுக்குத் தெரியப்படுத்தப்படும்.

ஆய்வாளரின் கையொப்பம்._____

தேதி:_____

ஆய்வுக்குட்படுபவரின் ஒப்புதல்

நான் இந்த ஆராய்ச்சியின் நோக்கம் மற்றும் அதன் பயன்பாட்டினைப் பற்றி தெளிவாகவும், விளக்கமாகவும் தெரியப்படுத்தப்பட்டுள்ளேன். இந்த ஆராய்ச்சியில் பங்கு கொள்ளவும். இந்த ஆராய்ச்சியின் மருத்துவ ரீதியான குறிப்புகளை வரும் காலத்திலும் உபயோகப்படுத்திக் கொள்ளவும் முழு மனதுடன் சம்மதிக்கிறேன்.

ஆய்வுக்குட்படுபவரின் பெயர், முகவரி :

கையொப்பம்: _____

தேதி:_____

ஆய்வாளரின் தொலைபேசி எண்:

மனித நெறிமுறைக் குழுவின் தொலைபேசி எண்: 0422-2570170 (Extn: 5818)

Key to Master Chart

KEY TO MASTER CHART

1. No – Number

2. Age

3. Score

   Primigravida – 0
   Multigravida – 1

4. GA –Gestational Age

   Term – 0
   Preterm – 1

5. BMI –Body Mass Index

   Normal – 0
   Overweight – 1
   Obese – 2
   Underweight – 3

6. Weight Gain in kg

   < 8 – 0
   8 to 13 – 1
   >13 – 2

7. DM - Diabetes Mellitus

   DM (-) – 0
   DM (+) – 1

8. PIH – Pregnancy Induced Hypertension

   PIH (-) – 0
   PIH (+) – 1

9. Anaemia

   Anaemia(-) – 0
   Anaemia(+) – 1

10. LV - Liquor Volume

Normal	– 0
Polyhydraminos	– 1
Oligohydraminos	– 2

11. MS – Membrane Status

Rupture of Membrane(ROM)	(-) – 0
Premature rupture of Membrane(PROM)	(+) – 1
Preterm premature rupture of Membrane(PPROM)	(+) – 2

12. VD – Vaginal Delivery

Vaginal Delivery(VD)	(-) – 0
Uncomplicated Vaginal Delivery(UVD)	(+) – 1
Complicated Vaginal Delivery(CVD)	(+) – 2

13. LSCS- Lower Segment Caesarean Section

LSCS	(-) – 0
Emergency LSCS	(+) – 1
Elective LSCS	(+) – 2

14. Pyrexia

Pyrexia (-) – 0
Pyrexia (+) – 1

15. PIH – Pregnancy Induced Hypertension

PIH (-) – 0
PIH (+) – 1

16. DWH – Delayed Wound Healing

DWH (-) – 0
DWH (+) – 1

17. TE – Thromboembolism

    TE (-) – 0
    TE (+) – 1

18. BW – Birth Weight

    Appropriate for Gestational Age(AGA) – 0
    Large for Gestational Age(LGA) – 1
    Small for gestational Age(SGA) – 2

19. AS – Apgar Score

    > 4 – 0
    4 – 7 – 1
    >7 – 2

Master chart

NO	AGE	SCORE	GA	BMI	WT GAIN	DM	PIH	ANAEMIA	LV	MS	VD	LSCS	PYREXIA	PPH	WH	TE	BW	AS
1	24	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
2	32	1	0	2	2	1	1	0	0	0	0	1	0	1	0	0	0	1
3	26	1	0	1	2	1	0	0	0	0	0	2	0	0	0	0	0	2
4	22	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
5	24	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	2
6	28	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	2	1
7	25	0	0	0	2	0	0	0	2	0	2	0	0	0	0	0	0	1
8	40	1	1	1	1	1	0	0	0	2	0	1	0	0	0	0	2	1
9	27	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
10	21	0	1	0	2	0	0	0	0	0	1	0	0	0	0	0	2	2
11	23	0	0	2	2	0	1	0	2	0	1	0	0	0	0	0	2	1
12	22	0	0	0	2	0	0	0	0	1	0	1	0	0	0	0	0	2
13	26	1	0	2	2	0	0	0	0	1	1	0	0	0	0	0	0	2
14	25	0	1	1	2	0	1	0	0	0	0	1	0	0	0	0	0	2
15	24	1	1	3	0	0	0	0	2	0	1	0	0	0	0	0	2	0
16	21	0	1	3	2	0	0	0	2	2	0	1	0	0	0	0	2	1
17	22	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
18	30	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	2	1
19	22	0	0	1	2	1	0	0	0	0	0	1	0	0	0	0	0	2
20	21	0	0	2	1	1	0	0	0	0	2	0	0	1	0	0	1	2
21	26	1	0	2	2	1	0	0	0	0	0	2	0	0	0	0	1	1
22	22	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
23	29	1	0	3	2	1	0	0	0	0	0	1	0	0	0	0	0	1
24	24	0	1	2	2	1	0	0	0	2	0	1	0	0	0	0	2	1
25	27	0	0	2	2	0	0	0	0	0	2	0	0	1	0	0	0	1
26	28	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
27	27	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
28	30	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	2	2
29	28	1	0	1	1	1	0	1	1	0	0	2	0	0	0	0	0	2
30	35	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	2
31	26	0	0	1	2	0	0	0	0	1	0	1	0	0	0	0	0	1
32	27	1	0	1	1	0	0	0	0	0	0	2	0	0	0	0	0	2
33	31	1	0	0	2	1	0	0	0	0	0	2	0	0	1	0	0	2
34	22	0	1	1	1	1	0	0	0	2	1	0	0	0	0	0	2	1
35	24	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
36	27	1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	2
37	22	0	0	3	2	0	1	1	0	0	1	0	0	0	0	0	0	2
38	23	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
39	26	0	0	3	1	0	0	0	0	0	1	0	0	0	0	0	2	2
40	26	0	0	0	1	0	0	0	2	0	0	1	0	0	0	0	0	2
41	27	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	2	2
42	28	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
43	26	0	0	3	1	0	0	1	2	0	1	0	0	0	0	0	0	2
44	27	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
45	26	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
46	22	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
47	31	0	0	2	2	0	1	0	0	0	0	1	0	0	0	0	2	1
48	23	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
49	23	1	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	2
50	23	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
51	22	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2

NO	AGE	SCORE	GA	BMI	WT GAIN	DM	PIH	ANAEMIA	LV	MS	VD	LSCS	PYREXIA	PPH	WH	TE	BW	AS
52	32	1	0	2	1	0	0	0	1	0	1	0	0	1	0	0	1	1
53	23	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
54	21	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
55	33	0	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	1
56	22	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
57	28	0	0	0	2	0	0	0	0	1	0	1	0	0	0	0	0	2
58	28	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
59	27	0	0	2	2	0	0	0	0	0	0	1	0	0	0	0	0	1
60	24	0	0	3	1	0	0	0	0	0	1	0	0	0	0	0	0	2
61	30	1	0	3	2	0	0	1	0	0	1	0	0	0	0	0	0	2
62	32	0	1	3	0	0	0	0	2	0	1	0	0	0	0	0	2	1
63	22	1	0	3	2	0	0	0	0	0	1	0	0	0	0	0	2	2
64	26	1	0	3	2	0	0	0	0	1	1	0	0	0	0	0	0	2
65	26	0	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0	2
66	26	1	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	2
67	30	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
68	24	1	0	3	0	0	0	0	0	0	1	0	0	0	0	0	2	2
69	23	0	0	1	1	0	0	0	0	1	0	1	0	1	0	0	0	2
70	22	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
71	24	0	1	0	1	0	0	0	0	2	0	1	0	0	0	0	2	1
72	25	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
73	23	0	0	0	1	0	0	0	2	0	2	0	0	0	0	0	0	2
74	23	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2
75	26	1	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	2
76	20	1	0	1	1	0	0	0	0	0	0	2	0	0	0	0	0	2
77	32	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	2	2
78	27	1	1	1	1	0	0	0	2	0	0	2	0	0	0	0	0	2
79	21	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2
80	37	1	0	0	1	1	0	0	0	0	0	2	0	0	0	0	0	2
81	26	0	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	2
82	21	1	0	1	1	0	1	0	0	1	1	0	0	0	0	0	0	2
83	31	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	2
84	27	1	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	2
85	18	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
86	19	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
87	21	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2
88	23	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
89	28	1	0	1	1	1	0	0	0	0	0	2	0	0	0	0	0	2
90	23	0	0	3	1	0	0	0	0	0	0	1	0	0	0	0	0	2
91	25	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2
92	21	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	2
93	21	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
94	22	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
95	23	1	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	2
96	25	1	0	1	0	0	0	0	2	0	0	2	0	0	0	0	0	2
97	33	1	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	2
98	31	1	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	2
99	27	1	0	1	2	0	1	0	1	0	1	0	0	0	0	0	0	2
100	32	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	2
101	23	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
102	25	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2

NO	AGE	SCORE	GA	BMI	WT GAIN	DM	PIH	ANAEMIA	LV	MS	VD	LSCS	PYREXIA	PPH	WH	TE	BW	AS
103	23	1	0	1	1	0	0	0	0	0	0	2	0	0	0	0	0	2
104	32	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	2
105	29	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	2
106	27	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
107	31	1	0	0	1	1	0	0	0	0	0	2	0	0	1	0	0	2
108	27	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
109	23	1	0	1	1	1	0	1	0	0	0	2	0	0	0	0	0	2
110	22	1	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	2
111	27	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
112	21	0	0	0	2	0	0	0	0	0	0	1	1	0	0	0	0	2
113	36	1	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	2
114	20	0	0	3	2	0	0	0	0	0	1	0	0	0	0	0	0	2
115	33	1	0	0	1	1	0	0	0	0	0	2	0	0	0	0	0	2
116	21	0	0	1	2	0	0	0	0	0	0	1	0	0	1	0	0	2
117	23	0	0	3	0	0	0	0	0	0	2	0	0	0	0	0	2	1
118	28	1	0	0	0	1	0	1	0	0	2	0	0	0	0	0	0	2
119	30	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	2
120	26	1	0	2	0	1	0	0	0	0	0	2	0	0	0	0	2	1
121	19	0	0	3	1	0	0	0	0	0	1	0	0	0	0	0	0	2
122	27	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	2
123	26	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2
124	21	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	2
125	30	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	2
126	26	1	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	2
127	18	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
128	26	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	2
129	33	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2
130	19	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	2	1
131	26	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
132	26	1	0	1	2	0	0	0	1	0	0	2	0	0	0	0	0	2
133	23	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
134	22	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	2
135	31	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	2	2
136	23	0	0	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0
137	26	0	0	3	1	0	0	0	0	0	1	0	0	0	0	0	2	1
138	20	0	0	3	1	0	0	0	0	0	1	0	0	0	0	0	0	2
139	23	0	0	0	1	0	0	0	2	1	1	0	0	0	0	0	0	2
140	23	0	0	3	1	0	0	1	0	0	0	1	0	0	0	0	2	1
141	28	0	0	1		0	0	0	0	0	2	0	0	0	0	0	2	2
142	24	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
143	26	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	2
144	24	1	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	2
145	27	1	0	0	1	0	0	0	2	0	1	0	0	0	0	0	0	2
146	36	1	0	2	0	1	0	0	0	0	1	0	0	0	1	0	0	2
147	23	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
148	26	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
149	24	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	2
150	21	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
151	28	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	2
152	26	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
153	28	1	0	1	2	1	0	0	0	0	0	2	0	0	0	0	0	2

NO	AGE	SCORE	GA	BMI	WT GAIN	DM	PIH	ANAEMIA	LV	MS	VD	LSCS	PYREXIA	PPH	WH	TE	BW	AS
154	21	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
155	23	0	0	1	2	1	0	0	0	0	0	2	0	0	0	0	1	2
156	24	0	0	0	1	0	0	0	2	0	1	0	0	0	0	0	2	1
157	26	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
158	24	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	1
159	34	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	2
160	27	1	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0	2
161	24	1	0	1	2	1	0	0	0	0	0	1	0	0	0	0	0	1
162	22	0	1	3	2	0	0	0	0	0	0	2	0	0	0	0	2	0
163	24	0	1	3	1	0	0	1	0	0	1	0	0	0	0	0	2	1
164	24	0	0	3	1	0	0	0	0	0	1	0	0	0	0	0	0	2
165	24	0	0	0	2	0	0	0	0	0	2	0	0	1	0	0	0	2
166	22	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	2
167	23	0	0	1	2	1	0	0	0	0	0	1	0	0	0	0	0	2
168	28	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
169	23	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	2	2
170	24	1	0	3	2	0	0	0	0	0	1	0	0	0	0	0	0	2
171	22	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	2
172	18	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	2
173	30	1	0	3	2	0	0	0	0	1	0	1	0	0	0	0	0	2
174	23	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2
175	25	0	0	3	1	0	0	0	0	1	1	0	0	0	0	0	2	1
176	23	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	2
177	20	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	2
178	37	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
179	18	0	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	1
180	22	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2
181	26	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
182	22	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	1	1
183	22	0	0	0	2	0	0	1	0	0	1	0	0	1	0	0	0	2
184	34	1	0	3	1	0	0	0	0	0	1	0	0	0	0	0	0	2
185	26	1	0	0	1	0	0	0	0	0	0	2	0	0	1	0	2	1
186	34	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	2
187	22	0	0	3	1	0	0	0	0	0	2	0	0	0	0	0	0	2
188	24	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2	1
189	31	1	1	1	1	1	0	0	1	0	0	1	0	1	0	0	0	2
190	28	1	0	1	0	0	0	1	0	1	1	0	0	1	0	0	0	2
191	25	1	1	0	1	0	0	0	0	2	0	1	0	0	0	0	2	1
192	22	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	2
193	27	0	0	1	1	0	1	0	0	0	2	0	0	0	0	0	0	2
194	21	1	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	1
195	25	1	0	3	0	0	0	1	0	0	1	0	0	0	0	0	0	2
196	25	0	0	1	2	0	0	0	0	0	1	0	0	0	0	0	0	2
197	26	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2
198	24	1	0	0	1	0	0	1	0	0	0	2	0	0	0	0	0	2
199	22	0	0	1	2	0	0	0	0	0	1	0	0	0	0	0	0	2
200	22	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
201	27	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	2
202	25	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	2
203	23	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	2
204	30	1	0	0	2	0	0	1	1	0	1	0	0	0	0	0	2	2