Maternal Body Composition during Pregnancy, Maternal Outcome & Neonatal Complications

Havagiray R. Chitme [1 & 2 *] • Dania Ali Al Numani [1] • Miaad Majid Al Dhahri [1] • Nouf Saif Al Mamari [1]

[1] Oman Medical College, Bowshar Campus, Muscat, Oman
[2] Faculty of Pharmacy, DIT University, Mussoorie Diversion Road, Dehradun, Uttarakhand, India
hrchitme@gmail.com

ABSTRACT

Background: It is well proven that becoming overweight and obese during pregnancy increase complications in mother while delivering and neonates.

Objective: Present study is envisaged to understand the correlation between maternal body composition and complications in mother and neonates.

Methodology: It is a cross sectional longitudinal prospective study carried out at a tertiary care hospital in Oman among 300 randomly selected pregnant women.

Results: Preeclampsia was recorded in 44% of patients and more than 67% of them were having more than one complaint. Maternal BMI, total visceral fat, resting metabolic rate are significantly ($p<0.05$) impacting neonatal birth weight and APGAR score. Maternal body age is correlated significantly ($p<0.05$) with birth weight and head circumference. The birth complication cesarean delivery, gestational diabetes, and gestational hypertension are significantly correlated with maternal body age, total body fat, and gestational age.

Conclusion: Authors conclude that majority of the pregnant woman in their third trimester suffering from overweight or from high-fat deposition in their bodies are noted to have risks of macrosomia, impaired APGAR score, gestational diabetes, gestational hypertension and undergo cesarean delivery.

To cite this article
[Chitme, H., R., Al Numani, D., A., Al Dhahri, M., M., & Al Mamari, N. S. (2019). Maternal Body Composition during Pregnancy, Maternal Outcome & Neonatal Complications. *The Journal of Middle East and North Africa Sciences*, 5(9), 5-13]. (P-ISSN 2412- 9763) - (e-ISSN 2412-8937). www.jomenas.org. **2**

Keywords: Body Composition; Total Body Fat; Pregnancy; Neonatal Complication; Maternal Complication; Birth Outcomes.

1. Introduction:

A progressive gain in weight during pregnancy is a natural phenomenon, however, overweight and obesity during pregnancy are considered to be an abnormality. The prevalence of pregnancy obesity increased over a period across all categories of age, race, education and smoking status (Kim et al., 2007). Large epidemiologic study in Sweden established that increase in pregnancy BMI was associated with a higher risk of adverse pregnancy complications as well as influence the in-utero environment affecting fetal development and health of the child later in life (Soens et al., 2008; Villamor & Cnattingius, 2006). Maternal obesity is considered to increase the risk of maternal complications such as spontaneous abortion, unexplained stillbirth due to preeclampsia and gestational diabetes. Further, it increases the risk for birth complications including cesarean delivery, infectious morbidity, thromboembolic events and endotracheal anesthesia (Soens et al., 2008). It is also illustrated that higher the maternal BMI in the first trimester and a greater increase in BMI throughout pregnancy are associated with a reduced likelihood of spontaneous labor at term, an increased risk of post-term pregnancy, and an increased rate of intrapartum complications (Denison et al., 2008).

Gestational obesity is known to influence in-utero programming thereby increase the risk of complications in fetus growth, development, and neural tube defect. It is considered to be due to reduction in the amount of folic acid reaching the developing embryo due to insufficient absorption and greater maternal metabolic demands, chronic hypoxia, and increased circulating levels of triglycerides, uric acid, estrogen, and insulin resistance (Farah et al., 2011). Birth weight, height, and size of neonate also got influenced by the weight gain during gestation (Ehrenberg et al., 2004). The variability in the composition of the maternal fat distribution recognized as maternal fat-free mass, and not fat mass, at 28 and 37 weeks gestation influenced birth weight (Mardones-Santander et al., 1998). An American longitudinal study of 63 women also found that birth weight correlated with maternal fat-free mass and not fat mass (Butte et al., 2003). Italian study using single frequency BIA reported that birth weight was predicted by both total body water and extracellular water in the second trimester of pregnancy and not later in the pregnancy (Ghezzi et al., 2001). American study found no correlation between birth weight and changes in maternal arm and leg fat mass between 28 and 37 weeks' gestation in any of the BMI categories (Hediger et al., 1994).

Uncertainties remain about whether it is the maternal fat or fat-free mass that has a greater influence on birth weight. Using bioelectrical impedance analysis (BIA), direct assessment of fat and fat-free masses can be made accurately during pregnancy (Fattah et al., 2009; Kyle et al., 2004).

The present study will evaluate the complex relationship between birth complications and pattern of maternal fat distribution. This will also help us to know the influence of BMI and fat distribution in third trimester on birth outcomes. Our findings will also have implications for the design of future full-scale longitudinal studies that assess maternal body fat composition changes during pregnancy and decreasing obstetric complications. The present study is a first of its kind in Oman, Gulf, and other Arab countries. Therefore, outcome of the study will bring awareness on importance of this field of research.

As in the rest of the world, the situation in the Arab countries is not better, and the increase in the weight of the pregnant mother has increased with the increase of its complications, like gestational diabetes and hypertension affecting both the mother and her child which as a result affects the Arab community as a whole. It is noticeable that the weight increase among pregnant woman in Oman has been increasing but it is still not as severe as it is in other parts of the world, and with the right precautions and measurements taken it could be reduced and the risks could be limited and avoided, still few percentages of pregnant woman and their children are suffering from the outcomes of the overweight and obesity which requires intensive health care, follow up and health awareness .

The present study is based on the hypothesis that it is established that maternal body fat composition and its distribution determine the attendant co-morbid conditions and it continues to have major health implications in both mother and baby. Therefore, we hypothesize that there is a strong correlation between the pattern of fat distribution during third trimester of pregnancy and complications in both mother and child at birth and other adverse consequences. The primary objective of this study is to identify the pattern of maternal body fat distribution that influencing mother, fetus and birth outcomes.

2. Methodology:

2.1. Selection of Participants

The present pilot study involved 300 randomly selected pregnant women visiting selected hospital between November 2017 and June 2018 when they presented for medical follow-up. Informed written consent was obtained. All women who have their gestational age of 27 weeks to 40 weeks and confirmed by ultrasound scan were included in the study. Abnormal pregnancies, pregnancies recommended for medical termination and multiple pregnancies will be excluded from the study. It was a cross over longitudinal prospective study carried out at Sohar polyclinic, Oman.

2.2. Instrument:

Digital weight and height scale was used to calculate BMI and birth weight of newborns. Multi-frequency eight electrode bioelectrical impedance analytical instrument (HBF- 375 Omran Body Composition Monitor, Japan) was used to measure body composition.

2.3. Data Collection Procedure:

2.3.1. Maternal Body Fat Composition:

Maternal body composition and weight were measured in a standardized way using multi-frequency eight electrodes bioelectrical impedance analysis. This instrument is approved by FDA for research in adults. The women were asked to empty her bladder prior to the measurement. They were asked to remove any heavy clothing items. To account for the weight of the clothes during the measurement 0.5 kg was deducted from the measured weight. The electrodes were cleaned, and the women were then asked to stand barefoot on the electrode panels. The feet positioned parallel in roughly equal proportions on each side of the heel and toe electrodes. The arms were allowed to hang naturally, and the back and knees were straight. The handles were then gripped lightly and pulled out and then the arms were allowed to hang down naturally. Contact between the arms and torso, and between the inner thighs were avoided during the measurement. When the measurement is complete the handgrips were placed back. At this visit, they have their weight and body composition measurements repeated. Going forward, the clinical outcomes of the pregnancy for both mother and baby were obtained from the medical records.

2.3.2. Maternal Body Composition Analysis:

The datasheet developed were used to record body composition of women during 27-40th week of pregnancy such as body weight, fat, free fat mass, muscle mass, percent body fat, BMI and waist-hip ratio will be measured.

2.3.3. Maternal Outcomes:

Maternal pregnancy outcomes examined were cesarean delivery, preeclampsia, age, hypertension, and diabetes at delivery.

2.3.4. Neonatal Outcomes:

Neonatal factors evaluated include APGAR score, birth weight, Neural tube defect, shoulder dystocia, gender, head circumference, jaundice, small for gestational age (<10th percentile), large for gestational age (>90th percentile), macrosomia, preterm delivery (<37 weeks), birth fracture and brachial plexus injury.

2.4. Medical Ethics:

The identity of the participants and findings are treated with the highest possible degree of confidentiality. Participants were clearly explained the purpose of the study and their written consent to take part in this study was sought prior to their inclusion. Participation in this study was voluntary and participants have the right to withdraw at any period of the investigation. Team members along with a nurse belonged to the respective hospital carried out collection of data. Information collected from the hospital and the patient herself remained confidential and stored.

2.5. Statistical Analysis:

Each case was given a case number and the information collected in this study was entered directly into SPSS version 23 (SPSS Inc. Chicago, IL, USA) and analyzed by using descriptive statistics such as mean and standard deviation for continuous numerical data, and for categorical data, percentage-frequency distribution was used. To determine the reproducibility of the measurement of maternal body composition, three measurements were carried in 2 min apart in a randomly selected sample of 300 women. The relationship of birth complications to a range of possible explanatory variables was investigated, in the first instance, by use of bivariate methods such as Pearson correlation coefficients and analysis of variance (ANOVA).

In order to estimate the true relationship between the patient's characteristics and birth complications. Authors used multiple logistic regression analysis. Backward stepwise logistic regression was used to adjust for confounding factors. A p-value of less than 0.05 was considered statistically significant.

3. Results:

3.1. Maternal Factors:

As given in table-1 and 2, all our Omani patients were almost equally distributed in the third trimester of pregnancy. Majority of women were from 19 years to 40 years of age. However, 82.8% of women body age was recorded to be between 41-49 years. About 70.4% of these pregnant women were having BMI between 25-35 kg/m^2. It is important to note that 98.7% of women waist/hip ratio was >0.9.

3.2. Maternal Body Composition:

Total body fat composition of the mother's body was high fat and very high-fat content in 49 and 41.6 percent of cases respectively. The total visceral fat content was very high in 32.2% of pregnant women and high in 24.2% of cases. Most of the women (88.6%) seem to be physically inactive during 3rd trimester of pregnancy. It is noted that 70.5% of women were having >45% of subcutaneous fat in legs whereas arm subcutaneous fat was in very high range (>45%) in 88.6% of patients. The skeletal muscle content of the whole body contrasted with body fat is <24.3% in 64.2% of women. Whereas the skeletal muscle content was in higher range in 62.1% but it was lower in trunk and arms (Table 1 & 2).

3.3. Medical Complaints of the Patients:

The complaints experienced by those patients varied but most of the complaints seen in the polyclinic were dizziness, hypertension, high blood sugar, difficulty in breathing, difficulty while getting up the stairs, back pain. Almost 44% of patient had preeclampsia and almost 67% of the patient had more than one complaint depending on the severity of their comorbidities (Table 1 & 2).

Table 1: *Body Fat Distribution During Pregnancy and Its Correlation to Maternal and Newborn Complications*

	Frequency	Percent
Maternal Factors		
Gestational age		
Month 7	60	40.3
Month 8	41	27.5
Month 9	48	32.2
Age		
19-24 years	22	14.8
25-29	42	28.2
30-34	49	32.8
35-40	28	18.8
41-46	8	5.4

Body Age		
19-24 years	5	3.4
25-29	3	2.0
30-34	2	1.3
35-40	16	10.7
41-46	123	82.8
BMI		
<18.5	2	0.8
18.5-25	10	7.3
25-30	52	34.9
30-35	53	35.5
35-40	20	13.4
>40	12	8.1
Waist/Hip ratio		
<0.8	2	1.3
>0.9	148	98.7
Maternal Body Composition		
Total body fat		
21-32.9	14	9.4
33-38.9	73	49
≥39	62	41.6
Total visceral fat		
≤9%	65	43.6
10-14%	36	24.2
≥15%	48	32.2
Resting metabolic rate		
<1800 kcal/day	132	88.6
>1800 kcal/day	17	11.4
Whole-body subcutaneous fat		
<25%	10	6.7
25-30%	11	7.4
30-35%	48	32.2
35-40%	46	30.9
40-45%	28	18.8
>45%	6	4
Trunk subcutaneous fat		
<25%	11	7.4
25-30%	44	29.5
30-35%	45	37.6
35-40%	31	20.8
40-45%	12	8.1
>45%	6	4
Arm subcutaneous fat		
<25%	5	3.4
25-30%	3	2
30-35%	1	0.6
35-40%	2	1.4
40-45%	6	4
>45%	132	88.6
Leg subcutaneous fat		
<25%	4	2.7
25-30%	3	2
30-35%	7	4.7
35-40%	4	2.7
40-45%	26	17.4
>45%	105	70.5
Skeletal muscle whole body		
<24.3	95	64.2
24.3 – 30.3	39	26.3
30.4-35.3	12	8.1
>35.4	2	1.3
Skeletal muscle trunk		
<24.3	129	86.6
24.3 – 30.3	12	8
30.4-35.3	4	2.7
>35.4	4	2.7
Skeletal muscle arm		
<24.3	93	63.5
24.3 – 30.3	35	23.7
30.4-35.3	14	9.4
>35.4	5	3.4
Skeletal muscle legs		
<24.3	10	6.8
24.3 – 30.3	10	6.8
30.4-35.3	36	24.3
>35.4	93	62.1
Maternal Complications		
Caesarian delivery	20	13.4
Preeclampsia	1	0.4
Gestational hypertension	6	4
Gestational diabetes	17	6.8
Neonatal Complications		
Birth weight		
<1500 g (Very low birth weight)	4	2.7
<2500 g (Low birth weight)	12	8
2500 – 4000 g (Normal)	128	85.9
>4000 g (Macrosomia)	5	3.4
Neural tube defect	-	-
Shoulder dystocia	-	-
Jaundice	65	43.6
Preterm delivery	14	9.4
Macrosomia	5	3.4
Birth fracture	-	-
Brachial plexus injury	-	-
APGAR Score		
5	1	0.7
6	4	2.7
7	22	14.7
8	55	36.9
9	67	45
Gender of Neonates		
Male	65	43.6
Female	84	56.4
Head circumference		
25-30 cm	7	4.7
30-32 cm	26	17.4
32-34 cm	77	51.7
≥34 cm	39	26.2

Table 2: *Descriptive Statistical Analysis of Maternal and Fetal Status.*

Maternal Status								
	Gestational age (Months)	**Age (Years)**	**Height (cm)**	**BMI (kg/m²)**	**Waist circumference (cm)**	**Hip circumference (cm)**	**W/H ratio**	**Resting metabolic rate**
Mean	7.92	30.68	155.8	31.55	102.25	90.31	1.84	1545.45
Median	8.0	30.0	155.0	30.8	101.0	91.0	1.14	1446.0
Std. Deviation	0.85	5.85	5.97	6.07	6.87	7.36	8.67	1055.26
	Total Body fat	**Total visceral fat**	**Body age**	**Whole body SC fat**	**Trunk SC fat**	**Arm SC fat**	**Legs SC fat**	**Skeletal muscle whole body**
Mean	38.47	12.7	50.74	35.14	32.76	50.95	48.34	23.62
Median	38.0	10.5	51.0	35.2	32.0	52.1	49.7	23.60
Std. Deviation	4.84	6.78	12.76	6.43	8.41	8.93	10.83	4.86
Neonatal Status								
	Birth weight		**Head Circumference**		**Weight (kg)**		**APGAR score**	
Mean	3170.68		32.79		76.13		8.23	
Median	3259.0		33.0		75.0		8.0	
Std. Deviation	610.97		1.99		13.45		0.85	

3.4. Spearman's rho Correlation Analysis of Maternal Body Composition and Birth Outcomes:

Indicates that maternal BMI is significantly ($p<0.05$) in correlation with neonatal birth weight and APGAR score. Whereas, maternal total visceral fat and body age are correlated significantly ($p<0.05$) with only APGAR score. It is to underline here that the resting metabolic rate and whole-body SC fat of mother are significantly ($p<0.05$) is correlated to birth weight (Table 3).

TABLE 3: *Spearman's rho Correlation Analysis of Maternal Body Composition and Birth Outcomes*

	Gestational age	Age	BMI	W/H ratio	Total Body fat	Total visceral fat	Resting metabolic rate	Body age	Whole body SC fat	Trunk SC fat	Arm SC fat	Legs SC fat	Skeletal muscle whole body	Skeletal muscle trunk	Skeletal muscle arm	Skeletal muscle legs
Birth weight	0.067	.119	0.163*	0.095	0.106	0.147	0.166*	0.147	0.175*	0.118	0.065	.054	-0.008	-0.086	-0.048	0.085
Head Circumference	0.141	.043	0.062	.039	0.101	0.073	0.12	0.12	0.115	0.097	0.042	-.004	0.014	-0.076	-0.037	0.048
APGAR score	-0.040	-.08	-.179*	0.013	-.122	-.183*	-0.135	-.188*	-0.105	-.101	-.022	0.064	-0.02	0.044	-0.063	-0.054

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

3.5. The Pearson Correlation Analysis of Maternal Body Composition and Birth Outcomes:

Pearson correlation analysis (two-tailed) of results carried out to correlate maternal body composition and birth outcomes shows that (Table 4) the maternal body age is correlated significantly ($p<0.05$) with birth weight and head circumference. Very significant ($p<0.01$) correlation is noted between neonatal APGAR score and maternal BMI, total visceral fat and body age. It also noted that there is a significant ($p<0.05$) correlation between BMI and total body fat of mother with neonatal birth weight and APGAR score respectively (Table 4).

3.6. Pearson Chi-Square Tests on Maternal and Neonatal Complications Correlations to Maternal Body Composition Asymptotic Significance (2-sided):

The birth complication caesarian delivery is significantly ($p<0.05$) correlated with maternal body age, total body fat and gestational age. The maternal complication gestational diabetes very significantly ($p<0.01$) correlated to gestational age, total visceral fat and waist circumference but significantly ($p<0.05$) correlated to body weight and waist/hip ratio. Highly significant ($p<0.001$) correlation was noted maternal age and waist/hip ratio with gestational hypertension. Similarly, very significant ($p<0.01$) and significant ($p<0.05$) correlation was noted between gestational hypertension and maternal total body fat, body age, total visceral fat and whole-body SC fat respectively.

Table 4. *Pearson Correlation Analysis of Maternal Body Composition and Birth Outcomes*

	Gestational age	Age	BMI	W/H ratio	Total Body fat	Total visceral fat	Resting metabolic rate	Body age	Whole body SC fat	Trunk SC fat	Arm SC fat	Legs SC fat	Skeletal muscle whole body	Skeletal muscle trunk	skeletal muscle arm	skeletal muscle legs
Birth weight	0.079	0.144	0.163*	0.01	0.083	0.132	0.015	0.18*	0.123	0.075	0.037	-.033	-0.039	-0.047	-0.041	0.022
Head Circumference	0.169*	0.074	0.150	-.033	0.088	0.111	0.073	0.178*	0.098	0.095	0.019	-.067	-0.023	-0.076	-0.063	-0.025
APGAR score	-0.059	-0.103	-.305**	-.022	-.169*	-.279**	-0.054	-.235**	-0.137	-.075	0.008	.179*	-0.002	0.079	-0.027	-0.032

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The neonatal complication macrosomia was highly significantly ($p<0.001$) correlated to maternal body age, total body fat, body weight, total visceral fat, waist circumference, and age. Very significant ($p<0.01$) correlation was noted with gestational age and waist/hip ratio with macrosomia.

Macrosomia complication is significantly ($p<0.05$) correlated with whole-body SC fat and resting metabolic rate of mother (Table 5).

4. Discussion:

The present study was a cross-sectional longitudinal prospective study examining the body fat composition in pregnant woman in their third trimester and the outcome complications by collecting, analyzing, and report information on actual cases of complicated outcomes of the patients that their data was collected at Sohar polyclinic, Oman. Authors studied medical necessity and appropriateness of not having high fat composition in the pregnant woman in their third trimester and the high effect of the high fat composition and related complications. All the patients visited the polyclinic were females in their third-trimester pregnancy. The results were similar to what was anticipated before starting and conducting the study.

A very high number (82.8%) of women body age was recorded to be between 41-49 years and 70.4% of these pregnant women were having BMI between 25-35 kg/m^2. More than 98% of women waist/hip ratio was >0.9; total visceral fat content was very high in 32.2% of pregnant women and high in 24.2% of cases.

These results are in line with the results presented in Omani women (Al-Lawati et al., 2003).

A retrospective cohort study included 2,652 pregnant Omani women who delivered at the Royal Hospital, Muscat, Oman, between November 2011 and April 2012. A significant number of gestational diabetes, gestational hypertension, Caesarean delivery, postpartum hemorrhage, and fetal macrosomia. It is also reported a significantly increased risk of various maternal antenatal complications, intrapartum and

Table 5: *Pearson Chi-Square Tests on Maternal and Neonatal Complications Correlation to Maternal Body Composition Asymptotic Significance (2-sided)*

	Body age	Total body fat	Gestational age	Weight	Total visceral fat	W/H ratio	Waist circumference	Age	Whole body SC fat	Resting Metabolic rate	BMI
Caesarian delivery	0.045	0.047	0.017	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05
Gestational diabetes	P>0.05	P>0.05	0.002	0.048	0.004	0.037	0.009	P>0.05	P>0.05	P>0.05	P>0.05
Gestational hypertension	0.02	0.002	P>0.05	0.16	0.03	0.042	0.001	0.001	0.03	P>0.05	P>0.05
Macrosomia	0.001	0.001	0.004	0.001	0.001	0.008	0.001	0.001	0.045	0.043	0.23

postpartum events and neonatal complications (Zutshi et al., 2018). In the recent past, a prospective cohort study was carried out among pregnant Omani women attending antenatal clinics in their first trimester in the Seeb province of Muscat, Oman presented higher relative risk of cesarean section, gestational diabetes, miscarriages, birth weight and body mass index in obese women (Al-Hakmani et al., 2016).

Results in this study show that most of the women (88.6%) seems to be physically inactive during 3rd trimester of pregnancy. It is noted that 70.5% of women were having >45% of subcutaneous fat in legs whereas arm subcutaneous fat was in very high range (>45%) in 88.6% of patients. The skeletal muscle content of the whole body was in contrast to body fat is <24.3% in 64.2% of women. Whereas the skeletal muscle content was in higher range in 62.1% but it was lower in trunk and arms.

The complaints experienced by those patients varied but most of the complaints seen in the polyclinic were dizziness, hypertension, high blood sugar, difficulty in breathing, difficulty while getting up the stairs, back pain. These complications are in line with the report of a previous study (Al-Moosa et al., 2006). An earlier study carried out among school children in Oman attributed the bodyweight of children to the obesity of mother (Hassan & Al-Kharusy, 2000). Correlation analysis of data obtained shows that maternal BMI, whole body SC fat, total visceral fat, and body have significant correlation with neonatal birth weight supporting earlier study (Gandhi et al., 2018).

One of the reasons for maternal high fat content and increased BMI in Omani women leading to maternal and neonatal complication could be due to higher fat intake (Brei et al., 2018), and not adhering to healthy eating habit (Chia et al., 2018). This could be the reason for higher rate of incidence of overweight and obesity in Omani population (Al-Kilani et al., 2012).

The fat consumption and accumulation of fat are correlated with body age. In this study, body of most of the women was highly aged than the actual age of women affecting adversely on birth weight and head circumference. These results are similar to the results reported in recent past (Loy et al., 2017). The previous study based on Oman reported the risk of cesarean section due to pre-pregnancy diabetes, increased BMI, advancing age and body age (Al Busaidi et al., 2012). A community-based cross-sectional study in Oman noticed that 38% had hyperglycemia, 19% hypertension, 34.5% had high total cholesterol, higher BMI, WC, WHR (Al-Lawati et al., 2008).

The neonatal complication macrosomia was highly significantly correlated to maternal body age, total body fat, body weight, total visceral fat, waist circumference, and age. These results support earlier study based on cord blood analysis carried out among Omani patients (Saleh et al., 2008). In this study, significant correlation was noted with gestational age, subcutaneous fat and waist/hip ratio with macrosomia could be mediated by maternal pregnancy CRP (Kuzawa et al., 2017; Davenport et al., 2018).

Macrosomia complication is significantly correlated with whole-body SC fat and resting metabolic rate of mother supporting meta-analysis and meta-regression study demanding the need for exercise during pregnancy to reduce at least 39% of macrosomic cases (Al-Habsi & Kilani, 2018). A study in Oman reported that 62% of the women involved in sitting, 35% in light physical activity and only 3% are involved in moderate to vigorous physical activity (Al-Habsi & Kilani, 2018).

Results in this study show that cases or patients with high fat composition are highly associated with preeclampsia, gestational diabetes and caesareans substantiating earlier study (Blackwell et al., 2016). The mechanism could be mediated through leptin, adiponectin, and insulin-like growth factors affecting transportation across placenta, blood flows into placenta and uterus (O'brien et al., 2017).

Detailed investigations on the type of complaints experienced by those patients varied but most complaints seen in the Sohar polyclinic were dizziness, back pain, difficulty in breathing, and difficulty in walking up the stairs, these complaints depend on the severity of the related comorbidities of each patient. Sohar polyclinic is a secondary healthcare institution that has different medical departments with different specialties, the polyclinic does not have admission but if the polyclinic doctor sees that there is a severe case then he/she will refer it to Sohar hospital where it might be admitted if there is a need for that.

5. Conclusion:

Authors conclude from this study that majority of the pregnant woman in their third trimester suffering from overweight or from high-fat deposition in their bodies will more likely suffer and their child from the related risks of overweight, weather during their pregnancy or during their delivery or later on after delivery and even for a lifetime if the baby is born with defects. However, authors recommend that increasing the health care campaigns and counseling the mother or woman who is planning for pregnancy can be life-changing after all prevention is better than treatment.

Acknowledgment

Authors would like to thank Sohar polyclinic administration, staff, and patients for their great cooperation in collecting the data required for this study.

Conflict of Interest:

Nil.

Source of Funding:
Nil.

Corresponding Author:
Havagiray R. Chitme, Prof.
Faculty of Pharmacy, DIT University, Mussoorie Diversion Road, Dehradun, Uttarakhand, India
E-mail: hrchitme@gmail.com

References:
1. Al Busaidi, I., Al-Farsi, Y., Ganguly, S., & Gowri, V. (2012). Obstetric and non-obstetric risk factors for cesarean section in Oman. *Oman medical journal*, *27*(6), 478.
2. Al-Habsi, A., & Kilani, H. (2015). Lifestyles of Adult Omani Women: Cross-sectional study on physical activity and sedentary behavior. *Sultan Qaboos University Medical Journal*, *15*(2), e257.
3. Al-Hakmani, F. M., Al-Fadhil, F. A., Al-Balushi, L. H., Al-Harthy, N. A., Al-Bahri, Z. A., Al-Rawahi, N. A., ... & Padmakumar, H. (2016). The effect of obesity on pregnancy and its outcome in the population of Oman, Seeb Province. *Oman medical journal*, *31*(1), 12.
4. Al-Kilani, H., Waly, M., & Yousef, R. (2012). Trends of Obesity and Overweight among College Students in Oman: A cross-sectional study. *Sultan Qaboos University Medical Journal*, *12*(1), 69.
5. Al-Lawati, J. A., & Jousilahti, P. (2008). Body mass index, waist circumference and waist-to-hip ratio cut-off points for categorization of obesity among Omani Arabs. *Public health nutrition*, *11*(1), 102-108.
6. Al-Lawati, J. A., Mohammed, A. J., Al-Hinai, H. Q., & Jousilahti, P. (2003). Prevalence of metabolic syndrome among Omani adults. *Diabetes care*, *26*(6), 1781-1785.
7. Al-Moosa, S., Allin, S., Jemiai, N., Al-Lawati, J., & Mossialos, E. (2006). Diabetes and urbanization in the Omani population: an analysis of national survey data. *Population health metrics*, *4*(1), 5.
8. Blackwell, S. C., Landon, M. B., Mele, L., Reddy, U. M., Casey, B. M., Wapner, R. J., ... & Catalano, P. (2016). Relationship between excessive gestational weight gain and neonatal adiposity in women with mild gestational diabetes mellitus. *Obstetrics and gynecology*, *128*(6), 1325.
9. Brei, C., Stecher, L., Meyer, D., Young, V., Much, D., Brunner, S., & Hauner, H. (2018). Impact of dietary macronutrient intake during early and late gestation on offspring body composition at Birth, 1, 3, and 5 Years of Age. *Nutrients*, *10*(5), 579.
10. Butte, N. F., Ellis, K. J., Wong, W. W., Hopkinson, J. M., & Smith, E. B. (2003). Composition of gestational weight gain impacts maternal fat retention and infant birth weight. *American journal of obstetrics and gynecology*, *189*(5), 1423-1432.
11. Chia, A. R., Tint, M. T., Han, C. Y., Chen, L. W., Colega, M., Aris, I. M., ... & Chong, Y. S. (2018). Adherence to a healthy eating index for pregnant women is associated with lower neonatal adiposity in a multiethnic Asian cohort: The Growing Up in Singapore Towards Healthy Outcomes (GUSTO) Study. *The American journal of clinical nutrition*, 107(1), 71-79.
12. Davenport, M. H., Meah, V. L., Ruchat, S. M., Davies, G. A., Skow, R. J., Barrowman, N., ... & Sobierajski, F. (2018). Impact of prenatal exercise on neonatal and childhood outcomes: a systematic review and meta-analysis. *Br J Sports Med*, *52*(21), 1386-1396.
13. Denison, F. C., Price, J., Graham, C., Wild, S., & Liston, W. A. (2008). Maternal obesity, length of gestation, risk of postdates pregnancy and spontaneous onset of labor at term. *BJOG: An International Journal of Obstetrics & Gynecology*, *115*(6), 720-725.
14. Ehrenberg, H. M., Mercer, B. M., & Catalano, P. M. (2004). The influence of obesity and diabetes on the prevalence of macrosomia. *American journal of obstetrics and gynecology*, *191*(3), 964-968.
15. Farah, N., Stuart, B., Donnelly, V., Kennelly, M. M., & Turner, M. J. (2011). The influence of maternal body composition on birth weight. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *157*(1), 14-17.
16. Fattah, C., Farah, N., Barry, S., O'connor, N., Stuart, B., & Turner, M. J. (2009). The measurement of maternal adiposity. *Journal of Obstetrics and Gynaecology*, *29*(8), 686-689.
17. Gandhi, M., Gandhi, R., Mack, L. M., Shypailo, R., Adolph, A. L., Puyau, M. R., ... & Butte, N. F. (2018). Impact of changes in maternal body composition on birth weight and neonatal fat mass in dichorionic twin pregnancies. *The American journal of clinical nutrition*, *108*(4), 716-721.
18. Ghezzi, F., Franchi, M., Balestreri, D., Lischetti, B., Mele, M. C., Alberico, S., & Bolis, P. (2001). Bioelectrical impedance analysis during pregnancy and neonatal birth weight. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *98*(2), 171-176.
19. Hassan, M. O., & Al-Kharusy, W. (2000). Physical fitness and fatness among Omani schoolboys: A pilot study. *Journal for scientific research. Medical sciences/Sultan Qaboos University*, *2*(1), 37.
20. Hediger, M. L., Scholl, T. O., Schall, J. I., Healey, M. F., & Fischer, R. L. (1994). Changes in maternal upper arm fat stores are predictors of variation in infant birth weight. *The Journal of nutrition*, *124*(1), 24-30.
21. Kim, S. Y., Dietz, P. M., England, L., Morrow, B., & Callaghan, W. M. (2007). Trends in pre-pregnancy

obesity in nine states, 1993–2003. *Obesity*, *15*(4), 986-993.
22. Kuzawa, C. W., Fried, R. L., Borja, J. B., & McDade, T. W. (2017). Maternal pregnancy C-reactive protein predicts offspring birth size and body composition in metropolitan Cebu, Philippines. *Journal of developmental origins of health and disease*, *8*(6), 674-681.
23. Kyle, U. G., Bosaeus, I., De Lorenzo, A. D., Deurenberg, P., & Elia, M. (2004). G! omez JM, Heitmann BL, Kent-Smith L, Melchior JC, Pirlich M, Scharfetter H, Schols AMWJ, Pichard C, Bioelectrical impedance analysis-part I: a review of principles and methods. *Clinical Nutrition*, *23*, 1226-1243.
24. Loy, S. L., Wee, P. H., Colega, M. T., Cheung, Y. B., Aris, I. M., Chan, J. K. Y., ... & Chong, Y. S. (2017). Maternal Night-Fasting Interval during Pregnancy Is Directly Associated with Neonatal Head Circumference and Adiposity in Girls but Not Boys. *The Journal of nutrition*, *147*(7), 1384-1391.
25. Mardones-Santander, F., Salazar, G., Rosso, P., & Villarroel, L. (1998). Maternal body composition near term and birth weight. *Obstetrics & Gynecology*, *91*(6), 873-877.
26. O'brien, C. M., Poprzeczny, A., & Dodd, J. M. (2017). Implications of maternal obesity on fetal growth and the role of ultrasound. *Expert review of endocrinology & metabolism*, *12*(1), 45-58.
27. Saleh, J., Al-Riyami, H. D., Chaudhary, T. A., & Cianflone, K. (2008). Cord blood ASP is predicted by maternal lipids and correlates with fetal birth weight. *Obesity*, *16*(6), 1193-1198.
28. Soens, M. A., Birnbach, D. J., Ranasinghe, J. S., & Van Zundert, A. (2008). Obstetric anesthesia for the obese and morbidly obese patient: an ounce of prevention is worth more than a pound of treatment. *Acta anaesthesiologist Scandinavica*, *52* (1), 6-19.
29. Villamor, E., & Cnattingius, S. (2006). Interpregnancy weight change and risk of adverse pregnancy outcomes: a population-based study. *The Lancet*, *368*(9542), 1164-1170.
30. Zutshi, A., Santhosh, J., Sheikh, J., Naeem, F., Al-Hamedi, A., Khan, S., & Al-Said, E. (2018). Implications of early pregnancy obesity on maternal, fetal and neonatal health: a retrospective cohort study from Oman. *Sultan Qaboos University medical journal*, *18*(1), e47.

Received July 12, 2019; revised July 28, 2018; accepted August 24, 2018; published online September 01, 2019